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TOWARD A TOTAL SYSTEM APPROACH TO AUTOMATED MATERIAL LOGISTICS SYSTEMS DEVELOPMENT IN THE DEPARTMENT OF THE NAVY

by

Leon Sangster Fiske

TOWARD A TOTAL SYSTEM APPROACH TO AUTOMATED MATERIAL LOGISTICS SYSTEMS DEVELOPMENT IN THE DEPARTMENT OF THE NAVY

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INTRODUCTION

In the past decade utilization of computers has increased well over tenfold in the Federal Government as a whole. The Department of Defense is the world's largest user of automatic data processing equipment. Within the DOD various automated systems have come into being as a direct result of improved automated data processing capability. Such areas as systems analysis, command and control, material logistics, communications, financial management, management information, personnel, medicine, and research and development have been particularly subject to the influence of the computer. The Office of the Secretary of Defense, principally since 1961, has fostered standard systems having DOD-wide application.

Material logistics systems in particular have been the target of much standardization. A degree of uniformity now exists within the DOD in such areas as requisitioning, issue, accounting, transportation, and material priority systems. However, at the same time there are indications that greatest efficiency through systems standardization and more economical use of ADP resources has not been possible because of the lack of an overall approach to planning and development of automated material logistics systems.

The need for a total systems approach to the development

of automated material logistics systems is not newly recognized, nor is there unanimity as to such need. At a minimum, the matter is controversial. Nevertheless the enactment of Public Law 89-306 in 1965 has had a tremendous impact toward the development of a total systems approach. Increased central direction and interest in standard systems at the OSD level has undoubtedly provided additional impetus and strong influence. Concomitantly, within the Department of the Navy, in addition to receipt of increased central direction from the OSD, practical success with the Polaris Project and other projects has dictated a growing awareness of the benefits of a total systems approach. Significant steps have been taken within the DOD and the Navy to achieve more effective systems planning and development. Indications are that such progress is continuing on an accelerated basis.

If the automated material logistics system is looked upon as an integrated whole, made up of a number of subsystems of varying complexities, the potential problem of a lack of interface between systems can be seen as a stumbling block to developing a total system. The role of the information system is receiving increasing attention by experts, and is thought to be of considerable significance in, and an integral part of, achieving system interface. It would appear that management information systems may be of similar significance in achieving an integrated or total systems approach to automated material logistics systems development.

This paper will examine the role of the information

system in the evolution of the total systems approach to automated material logistics systems planning and development in the Department of the Navy. It will consider some of the background factors which have fostered the approach, will examine the progress to date by looking at some of the on-going material logistics systems as well as present plans within the Navy for achieving further progress toward a total systems approach to material logistics systems development. Finally, an evaluation will be made and conclusions drawn with respect to the progress to date and in the future.

To adequately treat the dominant aspects of the subject, the breadth of coverage has necessarily been limited in order to ensure depth of coverage. There has been, therefore, no attempt to include in this paper all existing thought and opinion with respect to the "total systems approach." A synthesis has been developed, however, based on the research conducted and the material examined, which the writer hopes will serve as the basis and background for the thesis. Similarly, no attempt has been made to examine all the material logistics systems and subsystems in being--such an examination and evaluation would extend well beyond the reasonable physical limits and purposes of the paper.

The organization of the paper is intended to lead to an evaluation of the main research question, which is a determination of the extent of progress to a total systems approach to automated material logistics systems development in the Navy.

Chapter I is a discussion of the theoretical aspects and

current thought about a total systems approach, and the integrative nature of the systems process. The chapter concludes with a synthesis of what a total system is, the steps involved in systems development, and the dependent conditions and advantages of the total systems approach. Chapter II discusses the relevancy of management information systems to the total system approach. Chapter III views the environmental aspects in which the approach has evolved. Chapter IV analyzes some of the material logistics systems which have been developed within the Navy, as well as some typical interface relationships that exist with systems of the DOD and other departments. Chapter V describes on-going efforts within the Naval Material Command in developing a total systems approach for material logistics information systems. The final chapter (VI) provides an overall progress evaluation of the total systems approach and its possible future role in material logistics systems development.

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CHAPTER I

THE TOTAL SYSTEMS APPROACH

As indicated in the introduction the writer purports to show the evolution of the total systems approach to automated material logistics systems development in the Department of the Navy.

In this chapter it is intended to discuss the concept of a total systems approach. Its evolutionary aspects as applied to automated material logistics systems development will be discussed in Chapters III and IV, respectively.

There is no unanimity as to the meaning of "total systems". There are those who contend that while conceptually possible, practically speaking; "total systems" is not feasible--that it is a myth.[1] There is evidence, too, that the term "total systems" is rather loosely used with no consistency as to its meaning. It seems all the more appropriate therefore to provide an understanding of the term, which may fit the context of this paper, in order that any conclusions we may derive will be valid within the framework of our definition.

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[1]W.M.A. Brooker, "The Total Systems Myth", in Management Systems, ed. by Peter P. Schoderbek (New York: John Wiley & Sons, Inc., 1967), pp. 163-169.

Some Theoretical Aspects

Before defining "total systems" and "total systems approach", the meaning of the term "system" itself should be examined. The dictionary defines system as follows:

> . . . 1. An assemblage or combination of things or parts forming a complex or unitary whole: a mountain system; a railroad system. . . . 3. an ordered and comprehensive assemblage of facts, principles, methods, etc., in a particular field: a system of philosophy. 4. any formulated, regular, or special method or plan of procedure. 5. a method or manner of arrangement or procedure. 6. a number of heavenly bodies associated and acting together according to certain natural laws: the solar system. . . . 8. Biol a. an assemblage of organs or related tissues concerned with the same functioning unit. 9. a method or scheme of classification. . . . 13. the structure of society, business, politics, etc. . . . [1]

Further defined is "systematize" as "to arrange in or according to a system; reduce to a system; make systematic."[2] A leading text on systems theory and management states:

> A system is "an organized or complex whole, an assemblage or combination of things or parts forming a complex or unitary whole". The term system covers an extremely broad spectrum of concepts.[3]
>
> . . . it will be helpful to define systems more precisely as an array of components designed to accomplish a particular objective according to plan. There are three significant points in this definition. First, there must be a purpose, or objective, which the system is designed to perform. Second, there must be design, or an established arrangement of the components. Finally, inputs

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[1]The Random House Dictionary of the English Language: College Edition, ed. by Laurence Urdang, 1968, p. 1335.

[2]Ibid.

[3]Richard A. Johnson, Fremont A. Kast, and James E. Rosenweig, The Theory and Management of Systems (2nd ed.; New York: McGraw-Hill Book Company, 1967), p. 4.

> of information, energy, and materials must be allocated according to plan.[1]

In their discussion of "The Utility of System Models and Developmental Models for Practitioners", Warren Bennis, et al., indicate the concept of system encompasses the components of organization, interaction, interdependency, and integration of parts.[2]

A company in the aircraft industry, with reference to hardware systems, has defined "system" as "the sum total of parts making up a whole, including their interactions which operate within established (a) performance limits, (b) operational constraints, and (c) design constraints while achieving stated mission objectives".[3]

There appears to be a common thread running through these definitions. All definitions can be construed to include the assemblage, combination, array, or arrangement of parts, things, components into a complex, unitary whole, structure or organization. Thus, a more pervasive definition would appear to include the interaction (communications), interdependency (mutual need) and integration of the combination of parts into a unitary whole by means of a preconceived, designed plan to achieve predetermined stated purpose, objectives, or goals. The

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[1] *Ibid*., p. 113.

[2] Warren G. Bennis, Kenneth D. Benne, and Robert Chin, *The Planning of Change*, (New York: Holt, Rinehart and Winston, Inc., 1961), pp. 201-214.

[3] Robert E. Corrigan and Roger A. Kaufman, *Why System Engineering and System Functional Analysis for Total System Design*, (LB32142), (Long Beach, Calif.: Douglas Aircraft Group, reprint date May 1965), p. 36.

more pervasive meaning of "system" seems to carry with it an infusion of thought other than the mere mechanistic and authoritarian connotation of "the classicist school"[1] (or scientific management[2]). (What is seen is a parallel to the evolution of new management organization theory and policy, where a true interdisciplinary approach is advanced, oriented to a situational environment. This matter will be discussed more fully in Chapter III in its relation to the evolutionary aspects of the total systems approach.)

A real-world application of a system is seen in the business organization which can be viewed as a man-made system having interplay with its environment--customers, competitors, labor organizations, suppliers, government and other agencies. It is a system of interrelated parts working in conjunction with each other in order to accomplish a number of goals, both those of the organization and of the individual participants.

> . . . The aim of systems theory for business is to facilitate better understanding in a complex environment; that is, if the system within which managers make decisions can be provided as a more explicit framework (italics mine), then such decision-making should be easier to handle. But what are the elements of this systems theory which can be used as a framework for integrated decision-making? Will it require wholesale change on the part of organization structure and administrative behavior? Or can it fit into existing situations? In general, the new concepts of the various organizational and management schools can be applied to existing situations. Organizations will

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[1]Edmund P. Learned and Audrey T. Sproat, Organization Theory and Policy: Notes for Analysis, (Homewood, Illinois: Richard D. Irwin, Inc., 1966), pp. 3-4.

[2]Joseph L. Massie, Essentials of Management, (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1964), pp. 13-15.

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> . . . we want to emphasize the notion of systems as set forth in several layers. This connotes basic horizontal organization cutting across typical departmental lines. Thus the systems that are likely to be emphasized in the future will develop from tasks, projects, or programs, and authority will be vested in managers whose influence will cut across traditional departmental lines. The focus of attention is likely to turn more and more to patterns of material, energy, and information flow throughout organizations. Identifying information-decision systems will provide a useful means of analysis and synthesis. These concepts will be developed more fully throughout this book.[1]

If we view the business organization as a system of interrelated parts combining to seek certain goals, we may also see the primary force within the organization to be management, which coordinates the activities of the parts or subsystems into accomplishing the goals. The theory of systems concepts closely relates to a general theory of management that has evolved in recent years, which focuses attention on the fundamental administrative processes essential to an organization if it is to meet its primary goals and objectives.[2] "*These basic managerial processes are required for any type of organization--business, government, educational, social, and other activities where human and physical resources are combined to meet certain objectives*".[3] (italics mine) The processes are necessary in all functional areas of management--production, material logistics,

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[1]Johnson, *The Theory*, pp. 13-14.

[2]*Ibid*., p. 15.

[3]*Ibid*., p. 15.

finance, communications, et al. The processes have been described in many ways, although four basic functions have received general acceptance--planning, organizing, controlling and communicating. A slightly different description would be the processes of organizing, planning, leading, and controlling.[1] Another breakdown, expressed in terms of the key functions of management would be: decision making, organizing, staffing, planning, controlling, communicating, and directing.[2]

Irrespective of what we call the functions or processes required in management, and we shall use planning, organizing, controlling, and communicating, the functions constitute the structure, the means, and the measure, as well as provide the environment, in which the decision-making process is carried out. Essentially, management is the process whereby unrelated resources of men, material, machines and money are integrated into a total system for objective accomplishment. The total management process involves coordinating the four functions in order to meet the over-all objectives of the system.[3]

As the management process ideally involves the systematic coordination and integration of planning, organizing, controlling, and communicating, so does the systems approach to management involve these same processes. The making of management decisions

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[1]William H. Newman, Charles E. Summer, and E. Kirby Warren, The Process of Management: Concepts, Behavior, and Practice, (Englewood Cliff, New Jersey: Prentice-Hall, Inc., 1967), pp. 10-17.

[2]Massie, Management, p. 6.

[3]Newman, The Process, p. 16.

in an atmosphere of no system results in hazardous or chaotic situations.

Current Thought and Direction

The systems concept is not necessarily new. One can think of a ship on the high seas as a system with elements of planning, organizing, control and communication evident therein--and ships have been on the high seas for centuries, however simple or complex those systems be. The pervasiveness of systems concepts is most evident in recent years however.

The trend toward automation envolves implementation of systems concepts. Automation suggests a self-contained system with input, output and a mechanism of control. Automation as a concept recognizes the need to consider the environment within which the automatic system must perform. Thus the automated system can be recognized as a subpart of a larger system. Large groups of machines can be programmed to perform a series of operations, with automatic materials-handling devices providing the connecting links among the components of the system. In such a system, each individual operation could be described as a system and could be related to a larger system covering an entire operation. The particular processing operation also could be part of the total enterprise system, which in turn can be visualized as a part of an environmental system.[1] Another commonplace example today are the completely automated processing systems utilized in the oil and chemical

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[1]Johnson, The Theory, p. 17.

industries.[1]

While the above examples deal, at least partially, with physical processes, other aspects of automation have seen the systems concept utilized. A phase which has been automated, and one which is pertinent to this paper, is information flow. With the introduction of large-scale, electronic data processing equipment, data processing systems have been developed for many applications including material logistics systems with sub-systems for physical distribution of materials and paper work processing.

The science of managing material flow from the raw material stage through the many stages of processing and including the distribution of the finished product, is called rhochrematics.[2] The idea embraces systems concepts where emphasis is placed on the total system of material flow rather than on functions, departments or institutions which may be involved in the processing.[3] As applied to material flow management, the rhochrematics approach involves (1) reviewing the need for the function in terms of the objectives of the system, and (2) determining its cost and contribution in relation to other necessary functions.[4] "A new conceptual scheme is a necessary antecedent of the effective application

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[1] *Ibid.*, p. 205.

[2] *Ibid.*, p. 193.

[3] *Ibid.*, p. 17.

[4] *Ibid.*, p. 174.

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of rhocrematics on the industrial scene, i.e., the adoption by management of the view that movement of goods from raw material to consumer is a flow process which must be planned, organized, directed, and controlled as an integrated system."[1] The authors go on to say that acceptance of the view by top management is an essential prerequisite to the successful implementation of the system. Management support is crucial to the rhochrematics process of describing, simulating, analyzing, and ultimately changing the major flow of material and information throughout the entire business system.

It was cited earlier that in one sense the concept of system incompassed the components of organization, interaction, interdependency, and integration of parts. The word "integration" is defined in the dictionary as "1. The act or an instance of combining into an integral whole."[2] It can be seen that the definition of "integration" is closely related to the definition of "systematize"--"to arrange in or according to a system", as referred to previously. It is possible to think in terms, therefore, of an integration of systems (or systems integration) or a systematizing of systems where many systems are integrated into a super-unitary system or total system. By way of continuing the development of this point, it might appear

> The best way to view the system is by describing the flow process, analyzing each segment, and investigating the relationships and contributions of the parts to the whole. In this way it is possible to direct attention

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[1] Ibid., p. 193.

[2] Random House Dictionary, p. 692.

> and study to those segments which fail to optimize their contribution to the _total system_.[1] (italics mine)

The vitalist theory of deduction states:

1. The whole is primary and the parts are secondary.
2. Integration is the condition of the interrelatedness of the many parts within one.
3. The parts constitute an indissoluble whole that no part can be affected without affecting all other parts.
4. Parts play their role in light of the purpose for which the whole exists.
5. The nature of the part and its function is derived from its position in the whole and its behavior is regulated by the whole to part relationship.
6. The whole is any system or complex or configuration of energy and behaves like a single piece no matter how complex.
7. Everything should start with the whole as a premise and the parts and their relationships should evolve.[2]

A business firm, a government agency, or perhaps a segment of a military service (functional or organizational) can each be considered as an integrated whole where each system, subsystem, and supporting subsystem is associated with the total operation. Its structure, therefore, is created by many systems arranged in hierarchical order. The output of the smallest system becomes input for the next largest system, which in turn furnishes input for a higher level. Today, however, practically speaking, a truly integrated total operation, while possibly existent in certain instances, is probably, more often than not, only theoretically true.

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[1]Johnson, _The Theory_, p. 112.

[2]L. Thomas Hopkins, _Integration: Its Meaning and Application_, (New York: Appleton-Century-Crofts, Inc., 1937), pp. 36-49.

The Total Systems Approach

The total systems approach is essentially a concept of management. Whether with systems engineering, management engineering, business management, information systems management, material logistics systems management, or other functions or skills, the total systems approach is a way of thinking, frame of mind, or philosophy, rather than any certain body of knowledge or body of techniques.

In each of these categories of endeavor the concept provides a framework for visualizing internal and external environmental factors as an integrated whole. It recognizes the systems concept and the functions of subsystems and more complex supersystems and their interface and interrelationships. The concept fosters a way of thinking which, on the one hand, helps to dissolve some of the complexity and, on the other, helps the manager to recognize the nature of complex problems and thereby operate within the perceived environment. It is important to recognize the integrated nature of specific systems, including the fact that each system has both inputs and outputs and can be viewed as a self-contained unit. It is also important to recognize that the business/material logistics systems are part of or interact with larger systems on a possibly industry-wide/ defense-wide scale or with society as a whole.[1]

The meaning of the term "total systems", as used in this

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[1]Johnson, The Theory, p. 3.

paper, does not infer the complete processing of information or the monitoring of an organization by computer, i.e., completely machine-automated without human control or intervention. The meaning, rather, implies a man-machine system which is oriented to the hierarchy of goals and objectives that man has established for the whole (total) system or organization.

It has previously been indicated that the system concept is not new--yet the advent of automatic data processing systems have made feasible the reality of utilizing a total systems approach in systems management. The automatic data processing system has provided the means by which vast amounts of information can be communicated throughout the system for decision-making purposes. The total systems concept can be defined as an approach to systems design that conceives the organization as an entity composed of interdependent systems and subsystems, which, with the use of automatic data processing systems, provides timely and accurate management information which will permit optimum management decision-making.[1]

The organization, viewed as a supersystem (superior), system, or subsystem (subordinate), whether a government or private organization, program or project follows certain steps or phases in its functioning to reach its goals or objectives. Assuming the goals or objectives have been established by

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[1]Asa T. Spaulding, Jr., "Is the Total System Concept Practical?", in Management Systems, ed. by Peter P. Schoderbek (New York: John Wiley & Sons, Inc., 1967), pp. 149-153.

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management these steps in systems development are followed:

1. Management makes its initial decision, selecting from among several alternatives the projects it wants to initiate.

2. A plan is developed, with a forecast of appropriate systems needs and resources required.

3. Policy is established, that is, the framework and guidelines for accomplishment of the particular project, including criteria for evaluating results.

4. Design of the detailed system is carried out, including development of system procedures and the selection of the methods and techniques for carrying out the project.

5. The project is implemented.

6. The results phase of the project is reflected by information feedback, including records and reports.

7. Evaluation of the project is conducted by comparison and analysis of the results with the established criteria. The evaluation of the entire project (system) results in subsequent management decisions to carry on, modify, or cancel the project.[1] Nothing revolutionary is contained in the steps which are with slightly varying modifications common to many system development descriptions, the Navy's "procedure for coordination"[2] being no exception.

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[1] *Ibid.*, pp. 151-152.

[2] U.S., Department of the Navy, Office of the Secretary, Instruction 5200.14, *Management Information and Data Systems; plans and procedures for coordination of*, 3 November 1965.

The project is systematically coordinated and integrated by the basic management processes (earlier described) of planning, organizing, controlling, and communicating. The process of communicating is the connecting and integrating link within the project--the communication network ties together each step of the system. In the total management system the use of automatic data processing systems provides the medium for the information flow, and in addition provides the central control mechanism which permits interpretation of information received and decision-making.

While theoretical from a conceptual standpoint, the total system approach can be developed into a practical and workable system.[1] The practical application of the concept into a viable system depends, it appears to me, on the following dynamic conditions:

1. Top management backing. Foremost of all pre-requisites, is the genuine interest and strong backing of the highest (strategic) levels in the organizational hierarchy in achieving a fully integrated total system. Top managements interest can easily be measured in terms of resources allocated for development and implementation of the system.

2. Thoroughly defined and understood goals and objectives. Goals must be congruent with those of any super-system, and completely translatable into subordinate subsystem

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[1] Allan Harvey, "Systems Can Too Be Practical", in *Management Systems*, ed. by Peter P. Schoderbek (New York: John Wiley & Sons, Inc., 1967), pp. 154-162.

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objectives down through the management control level to the lowest operational level. Objectives must be expressed in concrete, rather than abstract terms and state desired system output at each level.

3. Filtered information. System output must be filtered horizontally or vertically as required, to be reflected as specifically comprehensive information to be utilized at each level or in each function for decision-making purposes.

4. Communications linkage. The communications process is of utmost and basic importance to the design of the system, linking the subsystems together and thereby facilitate the information filter. Communications is the information transporter.

5. Automatic data processing capability. While not a requisite of an information system, per se, ADPS can be the facilitating medium for controlling and communicating between and among subsystems and functions. ADP is a tool through which a total system is made feasible, and without which it would not be practical.

6. Building block capability. The subsystems are the building blocks by which the total system is constructed. The concept requires that the subsystems be individually compatible with the totally integrated system. The contribution of each subsystem in terms of information need and redundancy must be considered.

7. Optimum standardization of functional systems/ subsystems and integration of data base. Balancing between

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8. Integrated data bank. The data bank would contain, on a central or remote basis, as required, integrated data for all levels of the organizational hierarchy, available as information for functional as well as total system requirements.

9. Competent developmental staff. Both technological and managerial competence of high order to convert top management objectives into integrated systems and subsystems to comprise the total system.

The advantage of the total system approach could be expressed in many ways to suit the situation to which the concept is applied. Simply stated, it allows optimum visibility of the full range of factors through the flow of information to the decision-making process at all levels. The interrelationship of the total systems concept to management information systems concepts can be seen in Chapter II.

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CHAPTER II

MANAGEMENT INFORMATION SYSTEMS

The Science of Information

An understanding of information systems is founded on the theoretical conceptual foundations of information science--the theoretical discipline associated with mathematical applications, systems design and other information processing concepts. It is an interdisciplinary science, concerned with the contributions, efforts, and skills of librarians, logicians, linguists, engineers, mathematicians, and behavorial scientists. An information system can be seen to result from the application of information science.[1]

While communications implies information, a distinction can be made between "communication" and "information". Communications connotes intercourse by words, letters, or similar means, and involves interchange of thought or opinion--that is a _means_ of transporting. Information, on the other hand, concerns, in its broadest sense, that which is communicated.[2] Information,

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[1]H. Borko, "The Conceptual Foundations of Information Systems", Paper read at the symposium: _The Foundations of Access of Knowledge_, Syracuse University, Syracuse, New York, July 28-30, 1965.

[2]Johnson, _The Theory_, pp. 93-94.

the substance of communication systems, is conveyed both formally and informally.

A distinction can similarly be made between "data" and "information". Data are individual facts or statistics which may be, by themselves, only factual material having no particular meaning--such "raw" data may be used as the basis for reasoning or decision, or input to an information system (manual or automated). Not all data is information, and "information" to one person may be only "data" to another. Data existing in a management information system, must be "screened" within the system before it becomes meaningful information. The distinction that becomes apparent between data and information is the idea of meaning which may be considered a primary characteristic of information.

According to Peter Drucker, of the "empirical" school of organizational and management philosophy, the one particular tool a manager has at his disposal is information. He does not handle people--he motivates, guides and organizes people to do their own work by passing information in the form of spoken or written words or numbers.[1] The importance of information passed through the communications process, is a keynote of modern management philosophy--of the "human behavior", "social system", and "management science" schools, as well as the "empirical" school--which recognizes the truly interdisciplinary nature of information science.

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[1]Peter Drucker, The Practice of Management (New York: Harper & Row, Inc., 1954), p. 346.

What Is A Management Information System?

A management information system is "the total process by which raw data is collected, summarized, or processed and reported--with the emphasis on the ultimate reporting to management", by means of a simple manual process or by use of off-line or real-time computers or combinations of several systems and methods.[1] Paul R. Saunders, director of management information systems for American Airlines goes on to state that in a management information system the primary concern is with information rather than the method used to collect, accumulate, or interpret the data, and provides the following explanations to clarify the point:

> Data vs. information. The terms "data processing" and "information processing" are not interchangeable. . . . Data exist in a management information system, but the objective of such a system is to produce data which have meaning and usefulness, i.e., "information" for decision-making.
>
> Information management vs. management information. Most commerical systems in use, and most of those still being designed, are concerned with the managing of information or the achievement of more economical methods of collecting, transporting, processing, and displaying information. Much of the information being generated by today's automated systems is valueless for decision-making.
>
> Policy vs. operational decisions. The information requirements of executive management are different from those of middle managers, who are required to make the more immediate operational decisions. However, a management information system can be designed to serve either or both of these needs.
>
> Decision-making vs. decision-supporting. Computers make management decisions only under restricted circumstances and, even then, only in relation to highly routine

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[1]Paul R. Saunders, "Management Information Systems", in Systems and Procedures: A Handbook for Business and Industry, ed. by Victor Lazzaro (2nd ed.; Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1968), pp. 425-426.

What is A Management Information System

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> process. Computers can and do perform decisions by observing prescribed threshold limits. . . . But when introduced into a policy-level decision-making environment, the role of the computer is that of providing relevant information to support a higher, managerial level decision-making process.
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> In summary, a management information system is an organized method of providing each manager with all the data, and only that data which he needs to make decisions at the time he needs it, and in a form that aids his understanding and stimulates his actions.[1]

The ultimate goal of an effective management information system is to keep the various levels of management completely informed on all developments which affect them in the business. Those persons placing information into the system should know what data to collect and to tabulate, and management has the obligation to clearly define its requirements for internal information.[2]

The Importance to Management

It was previously stated that communication implies information and that information is the substance of communication, the connecting link in the management process. With respect to the management process, the importance of information should be evaluated in terms of its pertinence to the decision-making process, where it is the basic ingredient.

The importance of information to higher levels of management may be clearly seen in the following list of purposes for

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[1] *Ibid.*, pp. 426-427.

[2] James D. Gallagher, *Management Information Systems and The Computer*, (New York: American Management Association, 1961), p. 17.

which the top manager (executive) needs information:

1. Appraising results. Measuring results accomplished against objectives established for subordinate levels. Measurements can be broad, or can be compared on a recurring basis with established standards.

2. Warning of major troubles. Most executives receive at least one of the following barometers: regular reports; notification of exceptions--deviation from norms or standards; or a standing procedure where subordinates advise of pending difficulties.

3. Insuring that policies and standard methods are being followed. Some audit methodology where the executive would be advised on an exception basis, often by staff personnel.

4. Information for dealing with exceptional problems. Exceptional problems may be an indicator that operations are out of control. Such problems must be examined, although extensive use of the exception principle may be very time-consuming.

5. Grounds for giving pre-action approval. Thorough background information necessary for strategic matters.

6. Setting long-range plans, new policies. Information required on present practices, present problems, and expected future conditions.

7. Building up background for outside contacts. "Briefing" essential for obtaining current relevant information--good public relations and sound business practice.

8. Coaching and umpiring. Supervisory role of the

executive dictates that specific situational information be available.[1]

From the preceding list it may be sensed that the executive moves from one important situation to another. He should not be paralyzed by too much of the wrong kind of information, and should not be bogged down with excessive recurring detail. Information should be available someplace where the executive can obtain it as he needs it.[2]

Many leading companies suffer from an information crisis often without fully realizing it. The problem of inadequate information lies in the gap that exists between a static information system and the changing organizational structure. Adequacy of information is determined, not in the sense of there not being enough, but in terms of relevancy for setting objectives, for shaping alternative strategies, for making decisions, and for measuring results against planned goals. The trouble is that in most companies it is taken for granted that information necessary for performance of a manager's duties flows naturally to the job. While to a certain extent true in small organizations, it is not true in larger organizations. The cornerstone of building a compact, useful management information system is the determination of each executive's information needs. The key to the development of a dynamic and usable system of management

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[1]Newman, The Process, pp. 746-748.

[2]Ibid.

information is to conceive of information as it relates to two vital elements of the management process--planning and control.[1] Again, the important consideration in determining adequacy of information is the quality rather than the quantity.

The organization as well as management itself can be viewed as a hierarchy. The hierarchy is ordinarily depicted as a pyramid with top management, or the executive at the apex of the pyramid, responsible for the basic strategic planning decision functions of the organization. Middle management occupies the center of the pyramid, responsible for management control functions. At the base of the organizational/management pyramid is the operating level, responsible for operational control of the organization. John Dearden finds fault with completely equating the three classes of functions with the three levels in the organizational pyramid. He does this with some justification, inasmuch as it is evident, for instance, that middle managers are concerned with operational control problems as well as management control problems. While the distinction between strategic planning, management control, and operational control is not completely determined by the hierarchy within an organization[2] and realizing that top management may occasionally exercise some

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[1]D. Ronald Daniel, "Management Information Crisis," in Management Systems, ed. by Peter P. Schoderbek (New York: John Wiley & Sons, Inc., 1967), pp. 53-55.

[2]John Dearden, "Can Management Information Be Automated?", in William F. Boore and Jerry R. Murphy, The Computer Sampler: Management Perspectives on The Computer (New York: McGraw Hill Book Company, 1968), p. 341.

strictly operating level functions and vice versa, the concept of a hierarchy does, nevertheless, serve well for purposes of illustrating the importance of certain kinds of information to each of the three levels.

In accordance with the hierarchical model, management's functions can be classified as follows:

> 1. Strategic planning, which consists of (a) determining corporate policies and objectives; (b) deciding on any changes in these policies and objectives; and (c) deciding on the resources to be devoted to attaining these objectives.
> 2. Management control, which consists of (a) dividing the strategic plans into logical subdivisions; (b) providing the funds to carry out the subdivisions of the plan; (c) assigning the responsibility for carrying out each of the subdivisions of the plan to some individual; and (d) following up to see that the assignment is being satisfactorily carried out.
> 3. Operational control, which consists of (a) determining the specific men, equipment, material, and information necessary to accomplish the subdivision of the plan; (b) assigning these resources so that the plan can be carried out in the most efficient manner; and (c) comparing actual results with plans and taking corrective action where appropriate.[1]

By way of clarification, for practical purposes, strategic planning may be thought of as deciding on long-range plans and objectives; management control, as supervising and evaluating operational personnel; and operational control, as carrying out the day-to-day operations of the business.[2]

The foregoing has equal applicability to the Department of the Navy. The Navy can be viewed as a hierarchical structure, with three organizational levels of management, whose processes

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[1] *Ibid.*, p. 340.

[2] *Ibid.*, p. 341.

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are integrated by a communications network through which flows the stream of information necessary to perform strategic planning, management control, and operational control.

The structure of management information systems in the Navy closely parallels its management structure. The three levels may be equated to the Secretarial level (executive or strategic planning), the Command level (headquarters/system commands), and the Operating level (fleet and shore activities).

Similarly to Dearden's model, it is better not to consider as fixed the association of the three management functional classes with the three Navy organizational levels, but rather to consider that any organizational level may be involved with a problem normally associated with a management function at a higher or lower level. The hierarchy generalization, nevertheless, holds true.

At each of the three management levels there are three different kinds of information. Inherently different, the information inputs and outputs at the lower or operating level tends to be transactional in nature, subject to recurring or scheduled reporting, and thereby comparatively susceptible to automated communication networks. To a lesser extent, the middle or management level lends itself to condensed information output and inputs, in the nature of information requests and demand reports. At the top or executive planning level comparatively little of the output information from the operating level is direct input for decision-making purposes, the category of information required being of a special request nature in support

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of decisions. Thus the aggregation of automated information from the operating level to the top cannot be vertically condensed in any responsive manner. To be sure, the availability of automated data (as contrasted to information) is present for theoretical filtering to the top, however the gap between the theoretical and the practical have not been bridged as yet.

The problem is not one of quantity output from the operating level, as was earlier pointed out, but rather an inadequacy in the format, responsiveness, and materiality of the information that is presented to the executive level for decision-making purposes. This is, in the Navy, a result of the complexities of the organization, facilities, and weapon systems and the virtual plethora of management support systems in existence (not to mention the socio-political-economic factors that contribute in considerable degree to the complexity).

The complexities of weapons systems, the demand for information at the top, and the enormity of the Navy organization, as with the Defense establishment as a whole, has resulted in a proliferation of management data systems at the management level. Within the Naval Material Command (NMC) some 200 automated management information systems with 2,500 reports and a larger number of manual systems at the headquarters level were in existence in 1967 to enable managers at all levels within the NMC to carry out their responsibilities.[1] To the extent that the

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[1]T.J. Rudden, Jr., Rear Admiral, U.S. Navy, "Management Information Systems: The Life Blood of Management", Defense Industry Bulletin, Vol. 3, No. 1 (January 1967), p. 12.

systems are non-integrative and non-interfacing in design their value to support the executive level decision-making process is limited. Currently, because of the lack of system interface and integration, few of the systems communicate with one another. As a result inordinate demands for information have placed on the operating level to provide input to the systems. The problem is recognized, and the Navy has embarked on a major project effort to develop an integrated system, the Navy Logistics Information System (NAVLIS). NAVLIS is the subject of Chapter V.

Essentials Of A Management Information System

It is important to design an information system that supports control in the integration of the management processes. A flood of information flows through an organization by informal, face-to-face communications and by regular, formal reporting. To be assured of good control, a reporting system is needed--probably with at least some minimum formal reporting. Every manager should ensure that the report system in-being provides the right kind of information, to the right people, at the right time to enable effective control. The myriad of controls that exist within an organization give rise to the diversity of arrangements for information feedback. Based on the idea that self-control is the best way to get corrective action, feedback loops should be as short and quick as possible. Members of organizations should generally have direct access to information relevant to the performance of their work without having to go up and down the hierarchy to get it. Periodic review of reports

flow should be made to ensure adequacy of content, receipt and timing.[1]

In the design of an information system, manual or automated, a major challenge to the system designer is to integrate the organization's data base so that all levels of the organizational and management hierarchy may utilize the information that derives from the data base in the communications process. It can be seen that if the designer can be made aware of the total information needs of the organization, a positive first step to total system design is taken. The purpose of any information system is to communicate to the appropriate level, information which will aid in the decision-making process. The design of the system, however, must in reality be a compromise between a mutual understanding on the part of management and the system designer as to what is to be contained in the system, on the one hand, and the capability of the system, on the other hand, to process and communicate the flow of information (or data), irrespective of whether the system is manual or automated. The capability of automated data processing equipment to process vast amount of data is acknowledged, as are the limitations of any given level of organization to assimilate such data in terms of objective and valid information. The capacity of automated data systems to produce reports on a routine basis is likewise recognized, as is the lack of capability of automated systems to produce meaningful information (as opposed to data) on a demand basis to a given

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[1]Newman, The Process, pp. 753-755.

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level of organization without inordinate delays or prohibitive programming costs.

> Because the computer seems to promise an improvement in the availability and quality of information--which would meet a universal need--computer-based management information systems (MIS) are much discussed in management journals today, but many of the hopes now pinned to such systems seem to be derived from the acuteness of the need rather than the real likelihood of success.[1]

Ridley Rhind reflects the thought of a large body of expertise in the industrial, educational and defense world, where it is contended that while computer-based information systems can be of great value to management, nevertheless many of the claims for computers are unfounded. The tenor seems to be that judgement still remains with management and will continue to so remain for some time to come. A real danger is seen in believing that total reliance can be placed on automated management information systems for information needed in the decision-making process. John Dearden believes that:

> - Complex computer-controlled systems solve a limited type of management problems.
> - For the most part, only the lower levels of management are directly affected by automatic information systems.
> - The techniques that make present computer systems successful to not apply at all to more general management problems.
> - Attempts to apply these techniques to more general information systems can have serious consequences for the companies that try.[2]

Before considering automation, the adequacy of the

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[1]Ridley Rhind, "Management Information Systems: "Some Dreams Have Turned to Nightmares", Business Horizons, June, 1968, p. 37.

[2]Dearden, "Can Management Information Be Automated?", p. 339.

existing information system should be the primary concern of management, particularly with respect to the strategic planning and management control. The faults of an on-going inadequate information system cannot be corrected solely by use of the computer. Since an automated system can be used for only certain types of information, generally those of an operational nature, the attempt to automate all management information regardless of nature or place in the hierarchical structure is the wrong approach.[1]

The computer can best be utilized in processing information that possesses these general characteristics:

1. Interacting variables. The ability to perform arithmetic and logic operations with tremendous speed with mathematical models.

2. Reasonably accurate values. The need to express accurate relationships among variables, where the results of calculation are no more valid than the assumptions on which the calculations were based.

3. Speed. Information value may vary directly with speed.

4. Repetitive operations.

5. Need for accuracy.

6. Large amounts of information.[2]

Rhind states, "My current view of the potential of

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[1] Ibid., p. 350.

[2] Ibid., pp. 341-343.

computers in MIS is that their utility is greatest in aiding management of operations. The utility of computers in MIS designed to aid in strategic management is questionable, and their utility in the management control process is only slightly less so."[1] Citing three successful industrial applications of computer-based MIS, which he called logistics control systems, he attributes their success based on: (1) well-structured operating problems; (2) limited objectives, in the short term at least; and (3) high-volume processing of routine transactions.[2]

With respect to strategic planning and management control, Rhind has this to say:

> Even the most ambitious computer-based MIS restricts its field of vision to the history of events occurring within the corporation. Strategic management concerns itself with predicting the future and preparing to make the most of the opportunities that it offers. Since these opportunities by definition are frequently opportunities that the company has not yet grasped, I fail to see how an MIS with an internal and historic focus can be of very much help.
>
> . . . .
>
> Managers charged with strategic planning or the administration of management control systems are unlikely to benefit significantly from the use of the computer to improve information available to them. The most important reason is that they must exercise a great deal of discretion in their work, whereas the information they consider is often relatively basic--some gained from "unofficial", or informal sources, and some from the accounting system.[3]

Rhind sees the key to designing a successful, workable

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[1]Rhind, "Management Information". p. 41.

[2]*Ibid.*

[3]*Ibid.*, pp. 43-44.

computers in MIS is that their utili[illegible]

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computer-based MIS is to deliberately limit its scope in terms of:

> (1) the audience for which it is designed--and I would seek to serve managers charged with the smooth daily operation of line departments such as marketing, shipping, warehousing, transportation, or production; and (2) the data involved--and I would concentrate on logistics systems or on some special situations such as the DOD system . . . [1]

John Dearden, along with F. Warren McFarlan, classifies information in yet another way for determining whether it lends itself to automation. They see these five dichotomies of information:

1. Action vs. non-action.
2. Recurring vs. non-recurring.
3. Documentary vs. non-documentary.
4. Internal vs. external.
5. Historical vs. future.[2]

It is the action, documentary, recurring, internal, and historical types of information that are the primary candidates for automation. Conversely it appears that the opposite types are prime candidates for elimination from automation. The importance of good systems analysis is seen in the determination of whether or not to automate an information system.

Since non-documentary information is virtually impossible to control, it seems therefore impossible to automate. Similarly,

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[1] Ibid., p. 45.

[2] John Dearden and F. Warren McFarlan, Management Information Systems: Text and Cases (Homewood, Illinois: Richard D. Irwin, Inc., 1967), pp. 4-6.

information that is normally beyond organizational "control", such as external and futuristic information, is not likely to be automated, and, of course, the higher the echelon in an organization the more important such external and futuristic information becomes to the decision-making process.

It was previously indicated that it is the responsibility of management to inform the system designer of the needs to be contained in the information system, and the responsibility of the designer to comprehend the total system. Prior to installing a management information system, according to Joseph I. Barnett, Vice President of the Standard Program Corporation of New York, management must insure:

1. Adequate organizational discipline in order that common interfunctional procedures can be implemented.

2. Documentation of potential savings anticipated from installation of the system. The documentation must include reasonable supporting data to substantiate the savings, and to justify the investment of organization resources for such an undertaking.

3. A relatively stable management, especially at the policy-making level. Continual reorganization is not conducive to an environment effective systems design and installation. Paradoxically, a management information system, if properly designed, will help stabilize an organization as a result of the well defined responsibilities and controls required for the system.

4. That management is willing to commit its own time and interest to understand the various plans, techniques and equipment associated with the proposed system. Management should be aware in sufficient detail to enable intelligent monitoring of the costs and progress of the system.

5. The willingness of management to acquire and train a core of experienced systems personnel, ranging in size from one man in a small organization to a full staff of twenty or more in a major organization.

6. The presence within the organization of operational personnel who are knowledgeable in depth concerning the information requirements, methods, procedures, and techniques within the functions they are associated with. These personnel will play a major role in the design and implementation of such a system. Management must be willing to relinquish considerable time from the regular duties of these personnel for additional duties as members of the design and installation committee.[1]

What is described above is a key ingredient to a successful management information system development project--the importance of top management support is crucial to the success of the system.

The first step in the design of a management information system is the same as the first of the management processes discussed in Chapter I, that of planning. For any systems

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[1]Joseph I. Barnett, "How to Install a Management Information and Control System", Systems and Procedures Journal, XIX (October, 1966), pp. 10-14.

project a plan must be developed and approved before work is undertaken. A management information project might look like this:

Objective:

To develop an integrated management information system for the entire organization.

Steps:

1. Organize a study team comprised of representatives from all major activities of the organization. Most full-time members of the team should be experienced systems personnel from the organization's systems department (or management information systems division). Assign responsibilities and establish target dates for completion of each phase.

2. Review and document all present reporting systems and reports throughout the organization. (It may not be necessary to detail each step of the data processing systems.)

3. Interview all levels of management concerning their information needs, in light of both of the present reporting system and future requirements.

4. Develop recommendations for immediate improvements as they are recognized. After approval by management, schedule and oversee installation of these immediate improvements.

5. Design a new management information system as required and prepare a written proposal to management for approval. Include a schedule for installation, operating costs (and savings considerations), implementation costs, and personnel and data processing equipment requirements.

6. After appropriate approvals, install the new system.[1]

The Need For A Navy Material Management Information System

In an article in the Defense Industry Bulletin, RAdm. Thomas J. Rudden, Jr., USN, Deputy Chief of Naval Material (Programs and Financial Management) stated succinctly the Naval Material Command's case for Management Information Systems. "Everything that a manager does ultimately comes down to decision-making, and the science of management is the art of organizing facts for the decision-making process."[2] Gone are the days when managers used to keep everything in their heads. Management technology has provided a major leap forward in the business of assembly and retrieval of facts.

> . . . The complexities of manageing NMC [the Naval Material Command] requires formally organized management information systems, both automated and manual, which are geared to providing managers at all levels:
>
> - Data to support program proposals and requests for funds.
> - A means of assuring that statutes, agreements with Congressional committees, and other requirements originating outside the DOD relating to resources are complied with.
> - Information that is necessary to formulate objectives and plans, monitor their execution, and isolate problem areas with a factual basis for corrective action. The law of the exception applies here, namely, concentrate on those areas and facets which are above or below planned performance.[3]

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[1]Saunders, "Management Information Systems", pp. 432-433.

[2]Rudden, "Management Information", p. 12.

[3]*Ibid*.

The development of data systems has evolved slowly in the NMC, as well as in the Navy as a whole. Initially only manual systems, concentrating on material and financial records, were used where required to operate in various functional organizations. More sophistication was introduced: tabulating equipment and then first-generation computers. From this functional orientation to material data systems came the beginnings of the information systems that exist today in the NMC.

Long-range goals were established as early as 1959. Requirements for features and concepts were cited which envisioned an integrated navy management information system by 1970.[1] However by the mid-1960's it became apparent that the long-range goals would slip, primarily because of rapid technological development, both in ADP and in weapon systems, and because of the growing systems proliferation.

Now the reasons were more urgent than ever--systems were becoming more non-interfacing and non-integrative in nature--and the way was pointed toward a much needed totally integrated information system that would serve top management's decision-making process, as well as the needs of all levels of management down to the operating level. The emphasis on support of the operating forces, identified the primary management problem to be a totally interrelated and interdependent end product, namely

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[1]U.S. Department of The Navy, Office of the Secretary, Instruction P10462.7, Navy Data Processing Equipment Program, 16 April 1959.

the material support of the operating forces.[1] The NMC management process recognizes management information systems as a supporting process--the objective of management information systems being "to fill that void" between what management knows and what management needs to know.[2]

The Chief of Naval Material also saw the need for an "Advanced Management Information System" which would incorporate necessary management information improvements to provide for effective functioning at the top management level in the NMC. The need was corroborated by contractor findings which indicated that improvement was possible and stated that the following principles and system characteristics should be pursued for further development:

> - The system must first satisfy requirements for information essential to the accomplishment of the mission of the CNM.
> - It must be primarily responsive to the management information requirements of the CNM and his senior staff.
> - It must support the task of control, i.e., the management functions of monitoring, evaluating, reporting, coordinating, establishing policy, guiding and directing.
> - It should not duplicate other NMC systems.
> - It will, therefore, generally be concerned with selected summary information produced to a large degree by the operating systems of lower echelons.[3]

Further it was intended that any system developed would be mutually supportive of the lower echelons of the NMC and be

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[1]Rudden, "Management Information", p. 13.

[2]U.S., Department of the Navy, office of the Secretary, Instruction 10462.7B, Automatic Data Processing Program, 11 March 1966, AppH, Principles and Concepts, p. H-11.

[3]Rudden, "Management Information", p. 14.

compatible with their internal management information systems.

In supporting the goals of the NMC, a management information system concept was developed with the following features:

- System design to fit into logical place in the total management system, i.e., cross relating of NMC programs where required by coding and data elements standardization (e.g., where weapons project management and resource management systems have interfaces).

- System interfaces integrated into a coordinated management system and a coordinated supporting information system for use of NMC's system (functional) components and project management components.

- Information required to perform the management mission of each of the three management echelons (i.e., headquarters, system command/project manager, field activity levels) would be defined by that echelon.

- NMC headquarters level would insure a total system integrated data base for the NMC management information system.[1] Through the use of the annual Management Information Systems Plan, a requirement of higher Navy and DOD policy, guidance is provided for the evolution of new material logistics information systems development.

In spite of steady progress towards development of an integrated information system for material logistics in

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[1] *Ibid.*, pp. 14-16.

accordance with many of the original goals and concepts, the initial 1959 Department of the Navy objectives for mechanized data systems have slipped. However, in November of 1968, a new approach to Navy material logistics systems development was undertaken. The urgency and criticality of need for the development of a total material logistics information system was recognized by the establishment of the Navy Logistics Information System (NAVLIS) Special Project (PM14).[1]

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[1]U.S., Department of the Navy, Headquarters Naval Material Command, Instruction 5430.38, Navy Logistics Information System (NAVLIS) Project (PM14), 29 November 1968.

CHAPTER III

THE ENVIRONMENT OF AN EVOLUTION

Historical Beginnings

The environment of the evolution toward a total systems approach to planning and development had its beginnings at least in World War II and by close look it can be seen earlier.

The forerunner of the current trend to integration has from time to time been seen in the need for greater coordination between the military services. The responsibilities of the Army and Navy up to the time of the Spanish American War could fairly well be drawn by a line of demarcation between the land and the sea. "Generally the problems of the oceans were left to the Navy and those of the land were left to the Army".[1] As a result of recognized poor organization and inefficiency of the Santiago Expedition and jurisdictional disputes over newly acquired overseas possessions, central planning and advisory organizations came in to use in both the Army and the Navy, with emphasis for some needed mechanism of coordination at a level below the President. These organizations generally suffered

[1] C.W. Borklund, The Department of Defense (New York: Frederick A. Praeger, Publishers, 1968), p. 4.

because of the lack of working staff and probably the lack of a total commitment to joint coordinated effort on the part of both departments. The first such joint effort was the Joint Army and Navy Board in 1903, which was comprised of senior officers. It served as a forum for consideration of matters requiring interservice cooperation. It was the first faint appearance of unification in the military.[1]

World War I pointed up serious problems regarding the waste of time, money, and resources caused by conflicting demands on the nation for war material and from uncoordinated procurement. The emergence of airpower and its value as a significant military weapon came to the forefront as an issue in the 1920's. Brigadier General William "Billy" Mitchell in testimony before Congress advocated a third service--the Air Force, but at the same time urged Congress to coordinate all national defense under a Secretary of Defense. There were numerous studies and bills presented to Congress regarding a unified organization to handle military affairs during the period 1921 to 1945. The greatest push to unification came during the Depression when, as an economy measure to save $100 million, it was proposed to establish a single department for defense. The proposal was narrowly defeated in Congress.[2]

As a result of events and circumstances of World War II, by 1946 unification was being given serious consideration.

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[1]Harry B. Yoshpe and Stanley L. Falk, Organization for National Security (Washington, D.C.: Industrial College of the Armed Forces, 1963).

[2]Borklund, The Department, p. 5.

> Key pressures were the constantly increasing responsibilities of the chief executive; U.S. assumption of Free World leadership in the face of increasing Communistic aggression; the technological revolution, heralded first by military aircraft and later by atomic bombs, etc.; the success of combined operations of the Army-Navy-Air Force in World War II battles; and the rapidly rising costs of developing modern weaponry, as weighed against growing public demand for economy in military spending.[1]

"The creation of the Department of Defense resulted from the clear recognition that separate land, sea, and air warfare is gone forever".[2] The National Security Act of 1947 which established the Department of Defense did not provide for a unified department or even a federation. A confederation of three military departments was created instead, presided over by a Secretary of Defense with carefully enumerated powers.[3] Almost immediately on taking office, James Forrestal, the First Secretary, in his efforts to make the loose confederation work, recommended that "the statuatory authority of the Secretary of Defense should be materially strengthened . . . by making it clear that the Secretary of Defense has the responsibility for exercising 'direction, authority, and control' over the departments and agencies of the National Military Establishment".[4] In

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[1] Ibid., p. 6.

[2] Robert S. McNamara, "Managing the Department of Defense", Civil Service Journal, Vol. 4, No. 4, (April-May 1964), p. 1.

[3] Charles J. Hitch, "Evolution of the Department of Defense", Excerpt form the H. Rowan Gaither Lectures in Systems Science delivered at the University of California on 5-9 April 1965.

[4] First Report of the Secretary of Defense, 1948 (Washington: U.S. Government Printing Office, 1948), p. 3.

1953, and again in 1958, additional steps were taken to strengthen and increase further the responsibilities and authority of the Secretary, especially with regard to the operational direction of the armed forces and in the area of research and development. "The three military departments were no longer to be 'separately administered' and instead were only to be 'separately organized'."[1] In 1958, in addition, the chiefs of the military departments were taken out of the chain of command with regard to operational control of the unified and specified commands, where previously they had been serving as executive agents. The chain of command would now run from the Secretary via the Joint Chiefs of Staff to the unified commands but by-passing the military departments. President Eisenhower said, "Genuine unity is indispensable . . . No amount of subsequent coordination can eliminate duplication or doctrinal conflicts which are intruded into the first shaping of military programs".[2]

Charles J. Hitch stated that there was little unification in fact from 1947 to 1961 except in three areas: unified commands had been created in all overseas theaters and for continental air defense; Joint contingency plans established for use prior to the outbreak of hostilities--a first; and the civilian Secretaries

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[1]"Special Message to the Congress in Reorganization of the Defense Establishment, April 3, 1958", Public Papers of the Presidents, Dwight D. Eisenhower, 1958 (Washington: U.S. Government Printing Office, 1959), p. 279.

[2]Hitch, "Evolution of".

had taken control of the over-all level of the Defense budget in line with the federal budget, but with little effective control over expenditures because of the lack of the management techniques to do so.[1]

Global commitments growing out of the U.S. position of world leadership, and the vast strides made in communications and means of transportation had shrunk both the time and distance factors which influenced relationships throughout the world. The international problems of the U.S. and its military problems were clearly indivisible.[2]

The trend to increased central direction at the Departmental level and systems integration was evolving.

Technological Revolution

It has been pointed out that the systems concept is not new, however, the capability to exploit the concept has only been with us for a relatively short time. While the decade of the 1960's might be called the "era of the system" its impetus was as a result of the decades of technological breakthrough that preceded it.

The prodigious expansion of the American economy from the early 1900's to the present has been to great degree as a result of the techniques of mass production and mass transportation. In each of these areas, the application of systematic

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[1] *Ibid*.

[2] McNamara, "Managing the Department", p. 2.

ways of accomplishing the tasks of both men and machines have made more complex the processes of industry. Mass transportation heralded first by the railroads, then the rise of the trucking industry in the 1920's, and finally air transport from the 1950's to the present, with the latter, with its tremendously increased capacities, assuming more of the total burden.

The physical sciences have played an important role in the technological revolution. The introduction of radio in the 1920's and the improvement in the telephone have both been significant contributions to the improvement in the field of communications, which has together with transportation narrowed the time and distance between people and places. The development of thermal nuclear energy has altered many of the traditional concepts of war, making instantaneous holocaustic destruction, on a world-wide scale, a possibility to be given the highest priority to prevent. The development of electronics through practical application in World War II, singly had tremendous impact on the development of the industrial and military applications of today. The weapons system concept was a result of combining electronics and communications with the weapon into an "integrated" system.

With all these technological advances, however, came the requirement to manage the new technologies and the complex processes which produced the products of the new era. The information explosion was in evidence. The new processes

produced tremendous amounts of data, but the problem was one of sorting the voluminous data into meaningful information. "For the most part, the kind and form of information flowing to top management was not commensurate with the decisions they had to make."[1] Information theory which had its origins with the scientific research that accompanied the wartime development of radar, contains new insights into controls for production processes, organization and management. Information technology is built on the foundations of theory and of physical advances in electronics, optics, and other related sciences.[2] Information technology and computer technology have both advanced at an accelerating rate in the past twenty-five years.

The utility of the first generation of vacuum tube powered, application-oriented, scientific computer, was largely surpassed by the second generation of transistor-circuited, procedure-oriented computers which could perform computations in micro-seconds instead of seconds. About 1964, the third generation of computers came on the scene with their micro-miniature circuitry, 50 to 100 times smaller in size and performing at fantastic speeds in nano-seconds. Third generation computers are oriented to problem solving and are by output comparison to previous generations low-cost. Their capability

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[1]Robert Beyer, "A Positive Look at Management Information System", Financial Executive, (June 1968), p. 51.

[2]John Diebold, "The Application of Information Technology", in Management Systems, ed. by Peter P. Schoderbek (New York: John Wiley & Sons, Inc., 1967), pp. 47-48.

is many times over that of previous generations with random access and mass on-line storage, and are well suited to systems integration. Evidence indicates that computer capability in the 1970's could well exceed ten times the capability of today's computer at one-fifth of the cost.[1]

More and more man is becoming increasingly aware of the importance of the science of ecology. The interdependence of man, nature and science is seen clearly in the field of space exploration. The technological revolution has given us the tools to develop ways to better manage ourselves and our environment. The proper understanding of the capabilities of the tools available, and the interrelationships of the various disciplines used in systems management, offer a means by which a total systems approach can be used in the planning and development of automated material logistics systems.

Increased Central Direction and Control

The evolving process toward greater centralization has been on a Federal-wide level, as well as within the military sector. The growing tendency to more involvement of the various departments and agencies in the Federal Government in centrally directed programs has steadily increased since the Depression years--largely a result of changing norms of social responsibility. As was discussed in a previous section, a growing need had

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[1] John F. McCarthy, Jr., Associate Professor of Business Administration, George Washington University. Lecture before the Navy Financial Management Class. 12 March 1969.

been experienced for greater coordination, if not control, at higher levels in matters of defense. This need, culminated in the establishment of the Defense Department in 1947, was recognized by the President, the Congress, and to a greater or lesser extent by the military departments themselves. Despite the new department, until 1961, the military still largely held sway and ran things.

<u>The McNamara Revolution</u>

Secretary McNamara immediately upon appointment started implementing the broad powers already vested in the Secretary of Defense from the National Security Act of 1947 and its subsequent amendments. He later said:

> . . . it became clear that either of two broad philosophies of management could be followed by a Secretary of Defense. He could play an essentially passive role--a judicial role. In this role the Secretary would make the decisions required of him by law by approving recommendations made to him. [What previous Secretaries had done for the most part.] On the other hand, the Secretary of Defense could play an active role providing aggressive leadership--questioning, suggesting alternatives, proposing objectives, and stimulating progress. This active role represents my own philosophy of management. In talking to Mr. Gates and thinking about his experiences, I became convinced that there was room for and need of this kind of management philosophy in the Department of Defense.[1]

It was soon apparent that the Department of Defense <u>was</u> run by the Secretary of Defense.

Part of the evolving process, was a growing recognization of the need for considerable modification of the National

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[1]McNamara, "Managing the Department", p. 2.

defense strategy. The doctrines of "a bigger bang for the buck" and of "massive retaliation", policies of the previous decade were eventually seen to be unrealistic. The inability of the military to conduct effective conventional war because of its having "all its eggs in one basket" was pointed out by General Maxwell Taylor in the The Uncertain Trumpet, which influenced the change in strategic policies instituted by McNamara. The twin strategic doctrines of McNamara were the "controlled response" and the "conventional option" which were designed to make things less bad.[1] The doctrine of "controlled response" is, in essense, a control mechanism placed on massive retaliation where nuclear targets can be selected (e.g., the sparing of population centers but the destruction of military targets). The "conventional option" is the capability of meeting threats and fighting wars with other than nuclear weapons. Such an "all contingency" defense posture, infinitely complex in programming and development, and together with the increased cost and complexities of weapons and weapons-related systems during the last twenty years of the "technological revolution", would be dependent on administrative and management techniques that had not heretofore been utilized on a Departmental-wide basis. This was the McNamara legacy--the business of defense.

Required, were tools and techniques to assist in the

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[1]Stewart Alsop, The Center (New York: Harper & Row, Publishers, Inc., 1968), p. 139.

decision-making. Needed, was the means to determine what forces were necessary and the methodology to procure and support them as economically as possible. The Planning-Programming-Budgeting concept was the outgrowth of this need. Beginning with an examination and an analysis of the military contingencies faced by Defense throughout the world, the planning process entails determining force and support level objectives and specifying the future actions to accomplish the mission requirements. "To be really meaningful the defense program must be looked at in its entirety with each of its elements considered in light of the total program. This can only be done at the Department of Defense level".[1] (Italics mine) The 5-year program was thus devised. Programming is the process of translating force and support requirements into manpower and material resources which are time phased to meet planned objectives. The original nine principal interservice missions constituted the total program. The most important of the missions are the strategic offensive forces, which are essentially comprised of the B-52, intercontinental ballistic missiles and the Polaris forces. A significant thing is that the programming concept is mission oriented from a National viewpoint--the importance being in the mission and not the service which performs the mission. The 5-year program presents the proposed Force structure and the related costs. Each mission, and systems and projects within the mission, can

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[1]McNamara, "Managing The Department", p. 3.

be broken down, for instance, into numbers of planes, the investment involved, operating costs and personnel requirements. Competing programs are judged on their contribution to the mission to be accomplished and to the Defense effort as a whole. What is sought is a balanced defense posture. The total program is translated into the budget, which is the process of expressing the programmed manpower and material resource requirements in financial terms for funding. Thus there is a rational process of selecting, from among an array of alternatives, that combination that will provide the greatest defense within a given budget. No longer is an arbitrary amount of money given to each service to spend as it would to meet the objectives as interpreted by that service.

The judgment required in determining the proper balance between systems and programs cannot be limited to intuition or past experience alone. The range of choice is too broad; the number and type of alternatives too great. The technique of systems analysis or "quantitative common sense" was introduced to aid in the decision-making process. Systems analysis aims to assist the decision-maker by furnishing quantitative estimates of each of the alternative courses of action, on a cost-benefit or cost-effectiveness basis. It can be applied on a national level or on a functional or weapons system level. "System analysis provides the means for consideration and integration of all functions necessary for successful mission accomplishment and

emphasizes the optimization of total systems performance".[1]

There has been much criticism, especially in the early years, of the Planning-Programming-Budgeting concept and of systems analysis. Early criticism seems largely aimed at the aspects of both concepts which removed to the level of the Office of the Secretary of Defense, the ultimate decision-making powers previously lodged within the military services. However "priorities among major program objectives can be rationally determined only in context of the total program, and balance among all elements of the Defense effort can be achieved only at the DOD level".[2] The basic concepts are sound. That there have been inevitable errors, in cost effectiveness studies and in the selection of individual weapons systems, should not be a reflection on the concepts, but in the data and information that went into the analysis, or in the ultimate decision that was made, or from changes in the economic situation which could not have been foreseen.

There should be no substantial change in emphasis on the Planning-Programming-Budgeting concept or in the systems approach.[3] The change has been in the process since the report of the Hoover

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[1]Johnson, et al., The Theory, p. 145.

[2]Charles J. Hitch, "Retrospect and Prospect", Excerpt from the H. Rowan Gaither Lectures in Systems Science delivered at the University of California on 5-9 April 1965.

[3]Kenneth R. Wheeler, RAdm (SC) USN. Assistant Comptroller (Financial Management), Department of the Navy. Address before the Navy Financial Management Class. 18 March 1969.

Commission in 1947.[1] "Thus, no matter who comes into Defense, it is unlikely there will be any major, dramatic changes in the Defense program."[2] It appears that whatever change occurs will not be in what has to be done, but in the way it is accomplished, depending on whether the incumbent Secretary believes in exerting tight leadership control or believes more in delegating authority to others. Selznick says that centralized decision-making is necessary at certain stages of the organizational life cycle. Centralization is thus needed at the beginning of restructuring or redefinition of organizational goals:

> When top leadership cannot depend on adherence to its viewpoint, formal controls are required. . . . On the other hand, when the premises of official policy are well understood and widely accepted, centralization is more readily dispensable, hence we shall expect a relatively high degree of centralization . . . in the early stages of institutional development. Later, when homogeneity has been achieved, decentralization will be feasible without undue loss of control.[3]

Of particular relevance to the on-going total systems approach in material logistics planning and development has been the effort on the part of the Department of Defense to foster standard material logistics systems. That the supply and logistics business in Defense was shaken up is evidenced by the establishment of the Defense Supply Agency (DSA) in 1962. Its

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[1]Commission on Organization of the Executive Branch of the Government, Budgeting and Accounting: A Report to the Congress (Washington, D. C.: Government Printing Office, 1949, p. 8.

[2]Cyrus Vance as quoted by Borklund, The Department, p. 287.

[3]Philip Selznick, Leadership in Administration (Evanston, Ill.: Row, Peterson and Company, 1957), p. 113.

purpose: to provide the most effective and economical support of common supplies and services to all military services and Defense components[1] within time frames established by the military material priority system, which was itself now a uniform concept. Simultaneously and in conjunction with the setting up of the DSA, stock and inventory control, requisitioning and issue procedures, and record keeping began to be standardized, automated and computerized.[2] The criticism directed against the DSA and the standard material logistics systems development was of the same vein as the criticism directed against control of the total defense effort by the Secretary of Defense: DSA and efforts to standardize logistics systems were seen as threats to the traditional concept that the operational commander must control his own logistics. There is little question, however, from a cost-effectiveness point of view that the establishment of DSA and the DOD-directed standard programs have provided for a more effective Defense total effort. For example, the wholesale back-up concept inherent in the DSA system of common supply item support has worked quite well, and has surprised not a few of its earlier critics with the effectiveness of its support to the operating forces. Yet there is considerable opinion that perhaps the standard material logistics systems development in the Department has

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[1]Department of Defense, Supply Management Reference Book, DA Pamphlet No. 700-1 (Washington: Office of the Assistant Secretary of Defense (Installations and Logistics); 1965), p. 33.

[2]Borklund, The Department, p. 184.

not moved rapidly enough. There is obviously room for additional improvements in all functional standard systems development efforts. More forceful leadership is required on these standard systems.[1]

Government-wide Interest

Of considerable impact on the tendency to increased central direction and control has been the interest shown by the Congress. Always concerned with the dollar control of the military through the military appropriation system, there has been additional concern voiced in the Congress over the selection of specific weapons systems, the effectiveness of systems, including material logistics systems, and the conduct of the Defense business. The General Accounting Office, in its role as the "Watchdog of the Congress", has been particularly active in its inquiries over the systemization, standardization and effectiveness of the military logistics system. The Congress has exerted pressures which have, in effect, served as extra impetus for the development of standardized approaches to automated material logistics (information) systems.

An important factor contributing to the interest shown by the Congress has been the dynamic growth of computers used in the whole of the Federal Government. Billions of dollars of Federal monies have been invested in the development and installation of computer systems. The investment in computer and data processing

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[1]Charles A. Bowsher, Assistant Secretary of the Navy (Financial Management), Department of the Navy. Address before the Navy Financial Management Class. 25 February 1969.

not moved rapidly enough. There is [illegible] improvements in [illegible] efforts [illegible] systems.

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systems, communications facilities, site preparation, procedures, software, personnel, training, travel and contractual services has caused the electronic and data processing system to be regarded as a major and vital resource to accomplish the primary responsibilities of many Federal agencies.

The growth of computer utilization has not been orderly throughout the Government, which has resulted in ill-conceived and incompatable systems development.

The first hard look at utilization of ADP in the Government, other than during the annual budget review process, was taken in 1958 by the Bureau of the Budget. A comprehensive Government-wide ADP Responsibilities Study recognized the need of specialized management in ADP resources, for Government-wide coordination, and for accurate current information for all levels of management. The dynamic leadership and energetic coordination, that the study concluded was of vital necessity, never materialized. A few guidelines were issued. Prior to 1965, the GAO conducted several comprehensive audits and studies regarding ADP management, utilization and acquisition, which resulted in the identification of serious deficiencies in agency ADP acquisition and violation of BuBud guidelines. In reports submitted to the Congress, the GAO strongly recommended centralized coordination of the Government's ADP effort.

In 1963, in response to a Congressional request, President Kennedy directed the Bureau of the Budget to undertake a comprehensive review of Government policies with respect to the

acquisition and use of automatic data processing equipment and to prepare a report to Congress. In February 1965 the report was sent to President Johnson who approved the report's suggestions for improvement. In its conclusions the report indicated that there was a definite need to strengthen and augment the resources devoted to the management of ADP in the Government.[1] The findings of the report were similar to the BuBud report of 1958, some of the more important being:

1. The failure to consider all the potential of the new computer technology in the design of systems.

2. The high degree of incompatibility between systems, resulting from lack of standardization of equipment and techniques. ADP resource sharing and the exchange of information between systems was therefore difficult.

3. The absence of procedures for the exchange of data processing information within and between agencies.

4. The lack of a government-wide automatic data processing management information system or plan in existence.

5. The low utilization of ADP equipment among the agencies resulting in excessive costs to the government.

Almost immediately, the Bureau of the Budget was directed to promulgate to the executive agencies, the responsibilities of those agencies with respect to the administration and management

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[1]U.S. Congress, Senate, Committee on Government Operations, Report to the President on the Management of Automatic Data Processing in the Federal Government (Prepared by the Bureau of Budget) (89th Cong., 1st Sess., Doc. No. 15); Washington: U. S. Government Printing Office, 1965.

of automatic data processing activities. The responsibilities were set forth in a circular which was intended to provide for maximum cooperation and coordination between and among the staff and operating agencies of the executive branch.[1] Specific responsibilities were given to the Bureau of the Budget, the General Services Administration, and the heads of the Executive agencies. The responsibilities included the "merger or integration of data systems irrespective of intraagency or interagency organizational lines, when cost effectiveness in equipment utilization, data systems management, or program accomplishment can be increased."[2]

In 1963, the House Subcommittee on Census and Government Statistics conducted hearings on the use of electronic data processing equipment in the Federal Government. One of the principal purposes was to determine the impact of ADP on Government employees. In addition to making numerous recommendations concerning machine technology and people, with particular reference to displaced employees, recommendations were also made concerning reporting so as to evaluate EDP systems performance, procurement problems such as lease versus purchase, and standardization of EDP systems. Concerning the latter, the Committee Report concluded that "Standardization of electronic data processing systems is vital to the efficient and expeditious use of the systems by

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[1]U. S., Bureau of the Budget, Responsibilities for the Administration and Management of Automatic Data Processing Activities, Circular No. A-71, March 6, 1965, p. 1.

[2]Ibid., p. 5.

the Federal Government, and a serious need exists for a dynamic standardization program."[1] The House Committee on Government Operations conducted hearings on the subject that same year. In 1965, hearings were held on H.R. 4845--the "Brooks Bill". The purpose of the bill: to provide for the economic and efficient purchase, lease, maintenance, operation, and utilization of automatic data processing equipment by Federal departments and agencies.[2] After a thorough hearing, the bill, sponsored by Congressman Jack Brooks of Texas, was passed and became Public Law 89-306. The Law provided that the General Services Administration was responsible for the procurement, utilization and disposition of automatic data processing equipment; the Department of Commerce for the development of data processing standards and the provision of assistance to agencies in designing computer-based systems; and the Bureau of the Budget for exercising policy and fiscal control over the implementation of these authorities.

The President in 1966 issued a memorandum in which he directed the heads of departments and agencies to apply all possible means of utilizing the computer to provide better service to the public, improve agency performance and to reduce costs, while managing electronic computer activities at the

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[1] U. S., House, Committee on Post Office and Civil Service, Use of Electronic Data Processing Equipment in the Federal Government (88th Cong., 1st Sess., House Report No. 858); Washington: U. S. Government Printing Office, 1963.

[2] U. S., House. Committee on Government Operations, Report of the Committee on H.R. 4845 (Automatic Data Processing Equipment), (89th Cong., 1st Sess., House Report No. 802); Washington: U. S. Government Printing Office, 1963.

lowest possible cost.[1] He directed a reporting system be established.

In carrying out certain recommendations of Circular A-71, the Bureau of the Budget directed the establishment and maintenance of an integrated system to provide information for the management of automatic data processing activities in the Federal Government. "The Management Information System has been developed to facilitate and improve the management of the Government-wide ADP program and the ADP program within and between agencies" at a variety of levels.[2]

In 1968, the GAO in a report to the House Appropriations Committee on its inquiry into practices followed by the DOD components in acquiring and installing new automatic data processing equipment for use in computerized management systems, stated that "the Office of the Secretary of Defense has permitted the services and Defense agencies to develop management systems unilaterally and independently, without regard to inter-compatibility or relationships of the systems."[3] The GAO recommended that the Secretary of Defense:

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[1]U. S., The White House, The President's Memorandum to Heads of Departments and Agencies on "Use and Management of Computer Technology", June 28, 1966.

[2]U. S., Bureau of the Budget, ADP Management Information System, Circular No. A-83, April 20, 1967.

[3]U. S., General Accounting Office, Inquiry into Practices Followed by the Department of Defense Components in Acquiring and Installing New Automatic Data Processing Equipment for Use in Computerized Management Systems (Report to the Committee on Appropriations, House of Representatives, B-163074), March 13, 1968.

1. Direct that an overall plan be developed to serve as a framework within which system improvement projects are to be developed.

2. Require that the concepts and objectives of system improvement projects adhere to the concepts and objectives of the overall plan.

3. Direct that a study be made of the system improvement projects now underway to ensure that the projects are in conformity with the DOD management scheme.[1]

The interest for improved practices in the development of ADP systems can be seen to be on a Government-wide basis. Both the Congress and the Executive Branch of the Government have shown considerable interest in maximizing the benefits to be gained from increased utilization of the computer. The trend to centralization of policy and control is becoming more evident, with more inquiry, and study into the way the DOD manages. The broad-based pressures for systems standardization and integration between departments, management information systems, computer sharing dictate continued pursuit by the DOD and Navy to a total systems approach to planning and development of automated material logistics systems development. In reporting on the need for improved planning to ensure standardization and compatibility among systems, GAO stated:

> It is our opinion that, until DOD devises and implements one overall plan and the planning and development of major ADP systems are closely controlled within the framework of the plan, conditions such as those encountered by the Navy will continue to occur throughout the DOD at a significant expenditure of time, effort, and funds.[2]

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[1] _Ibid._, p. 23

[2] _Ibid._, p. 7.

Management Revolution

The importance of the human element in Defense as in business is recognized. The process of introducing complex systems into organizations is part science and part art. The science includes the comprehension and design of the technical parts of the system, and the art involves the process of introduction primarily with regard to the human element.[1] The human elements are those concerned with attitudes, which are the core of resistance to change, factors of status, and the informal relationships that exist in every organization. A manager must recognize these as valid elements to consider, and important to the ultimate success of systems efforts.

Many of the ideas of the McNamara revolution can be seen, conceptually in the several schools of thought of organization and management theory and policy. Perhaps foremost among them would be the "management science" school which is concerned primarily with decision-making, but only with that class of decisions which can put to use new mathematical techniques and computers. The purpose is to improve the rationality of decisions. Well publicized, and used in cost-benefit and systems analysis, are such tools as mathematical and dynamic programming, symbolic logic, and factor analysis which are useful in coping with the complexities of an enormous number of variables

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[1]Lawrence K. Williams, "The Human Side of a Systems Change", in Systems and Procedures Journal, (July-August, 1964), pp. 40-43.

interrelated in many different ways so that hundreds, if not thousands, of possible solutions exist. The tools of probability, queuing, decision, and game theory are useful for coping with variability, the presence of change factors or "acts of God." The tools of sampling, statistical inference, Monte Carlo methods, and simulation are tools for coping with lack of information.[1] There are two major ways in which these operations research tools have helped top Defense management: 1) they have provided fresh impetus to taking a system approach to problems, where emphasis is placed on the interrelatedness of all the subsystems or parts that go into making up a complex whole; and 2) they have provided useful selected techniques in carrying out the high-level responsibilities of long-range planning and planning and control of major projects.

Additional schools of thought having impact on the organization and management methodology of Defense are the "social system" school and the "empirical" school. The former places great reliance on the total organization as a cooperative coalition. A system orientation, this school recognizes the interdependencies and interrelatedness of the parts in their contribution--or impediment--to the goals of the organization. The "empirical" school recognizes the management as a study of experience benefiting from all the other schools--a true interdisciplinary approach.[2]

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[1]Abe Shuchman, Scientific Decision Making in Business, (New York: Holt, Rinehart and Winston, Inc., 1963), pp. 146-148.

[2]Learned, et al., "Organization Theory and Policy", p. 4-7.

With respect to leadership styles, the Defense Department seems to have evolved to a "consultative" type of management, at the top, and to a certain extent at the middle management level, as well, rather than to a strict authoritarian style as of old. Dependent on clear statements of strategy and policy, "consultative" management, is also dependent on energy, self-control, ambition, responsibility, creativity, intelligence, group contributions, and clear communications channels. Such factors are conducive to "bringing along" persons with potential for advancement, and hence is "developmentalist" management.[1]

The frequent criticism heard, that the programming system and increased reliance on systems analysis have acted to downgrade the role of military judgment, has been equally often denied by top Defense civilians, who have stated that uniformed military planners actually have greater opportunity for influence than ever before.[2] It seems fair to say that far more than just military judgment in the traditional sense, is required and is entering in to the decision-making process. If the "consultative" approach to Defense management is seen on the increase, then it does seem that military "judgment" will play an important role, but not the only role, in the decision-making process.

The various schools of thought of organization and management theory have pointed up the interrelatedness of organizational structure, the processes of management, and patterns of

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[1]Ibid., pp. 108-110.

[2]Hitch, "Retrospect and Prospect".

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human behavior. The significance of the impact on managerial strategy and organizational make-up of the Department of Defense cannot be measured, but it is believed to be extensive. The contributions of the "management science" school have been of particular significance to the present day leadership styles and decision-making process in the Department. Yet, there needs to be still more emphasis placed on human factors and less on systems for systems sake, including holding people responsible for their actions.[1]

The Navy ADP Program

In 1959, the Secretary of the Navy formally established, in a Navy-wide plan, a long-range goal to have, by 1970, an integrated management information system within the Department. It was stated that by the mid-1960's it was expected to have installed a full range of ADP/equipment, with adequate technical personnel on board, having the capability to obtain that long range objective. During the period 1965 to 1970 it was expected that the primary developmental activity by Navy components would be devoted to "the perfection of the best ways and means for management to constitute itself and use the advanced hardware and technical personnel--with a very high degree of common characteristics Navy-wide."[2] The end result was to be an integrated

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[1]Bowsher, address, February 25, 1969.

[2]U. S., Department of the Navy, Office of the Secretary, Instruction P10462.7, Navy Data Processing Equipment Program. 16 April 1959, pp. ii-4.

Navy Management Information System.

To date, the ambitious goal has not been achieved. The reasons for the delay are more complex than numerous, but the reason was not because of a lack of technological capability to develop an integrated system.

The goals established by the Secretary of the Navy in 1959, seem remarkably pertinent today, considering they were established in an era when automatic data processing equipment was in its infancy. For instance the long-range plan for an integrated management information system called for:

- The evaluation of the initial automatic data processing equipment installations; extension of early experience developed to all levels of activities.

- An awareness of the full potential of automatic data processing.

- A shift of application emphasis to the areas of planning, programming and scheduling, etc., in addition to the common sense uses stemming from reduction of clerical effort.

- A shift in emphasis to more centrally developed programs in the design of more optimum management information systems utilizing operations research techniques.

- A maturity of hardware (third generation computers with improved input-output capabilities).

- The development of an overall Navy plan to bring about the complete transition of all resources to a full complement of information systems and hardware.[1]

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[1]Ibid.

The 1959 plan proposed a decentralized bottom-up approach in the design, development, and introduction of ADP equipment and software. Each bureau and major office in the Navy was assigned responsibility for ADP systems development within their particular (chiefly functional) area. The failure to establish bureau by bureau objectives is reflected in the pace differential with which each bureau approached the task.

Some seven years after the Air Force had installed its first workable system, the Secretary of the Navy, in response to a DOD directive, promulgated plans and procedures for coordination of management information and data systems within the Department.[1] Responsibility was placed directly at the highest level, in the Special Assistant to the Secretary of the Navy (SASN). Additionally, the Office of Management Information (OMI) was established to assist in achieving coordination and compatibility. It is noted that it was specifically stressed that "One objective of this Instruction is to provide the basic plan for assuring the proper coordination of management information and data systems <u>without limiting the fundamental responsibilities of the heads of Departmental components</u> for the development of management information and data systems".[2] That the fundamental responsibilities of heads of Departmental components were cited as being concepts that "were long accepted and strongly

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[1]U. S., Department of the Navy, SecNavInst 5200.14, <u>Management Information and Data Systems</u>, November 3, 1965.

[2]<u>Ibid</u>., p. 3.

supported", was a major contributing factor to the rampant system proliferation that followed. The net effect of the continuation of this policy in the datamation area was to continue to license the bottom-up approach (or at least quasi-bottom-up approach), which seems to have proven to considerably delay the integration of material logistics information systems.

The traditional responsibilities of the traditional bureaus, functionally oriented, and tending to the parochial in outlook, could not, without strong central direction, help but orient the development of the slowly evolving automated material logistics system in a functional and parochial manner. The strong central direction was absent, and so the "properly and adequately coordinated [information systems] to assure optimum compatibility for management purposes"[1] was improbable. Citing the complexities in data and information design and the high costs involved as the reasons for slippage of the original goals, RAdm T. J. Rudden, Deputy Chief of Naval Material (Programs and Financial Management), went on to say in an article published in 1967, that progress to date in both systems design and hardware installation indicates that the objective is feasible.[2] It appears also that the tremendous acceleration in technological development in the past ten years, in both ADP and weapons systems, along with the obvious systems proliferation in the

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[1] Ibid.

[2] T. J. Rudden, Jr., Rear Admiral, U. S. N., "Management Information Systems: The Life Blood of Management", Defense Industry Bulletin, Vol. 3, No. 1, (January 1967), p. 13.

Naval Material Command (NMC), as well as in the Navy and DOD as a whole, is at least a major cause of the slippage. As an example, one only has to think of the tremendous task of coordination necessary, in the presence of guidance and in the absence of strong central direction and control, in the data elements and codes standardization program, not only within the NMC, but throughout the entire Navy where standard DOD programs are being pushed.

The need for increased control over the use of ADP equipment was becoming more evident in the Navy as well as the Federal Government as a whole, through the expanding rate of growth of ADP utilization, and undoubtedly had some bearing on the tremendous reams of paper that were spewing forth in ever increasing amounts from lower to upper echelons. However, what was forthcoming was often the wrong information, or merely data rather than information. The belief that operating levels could, by use of the computer, produce meaningful information for higher echelons was overated. At the higher levels, unwarranted reams of paper work to produce, for example, 75 copies of a 200 page program change proposal, was as a result of having to, in fact, manually approach and otherwise systemized program.[1]

In 1966 the traditional bureau system in the Navy was revamped, placing under the Chief of Naval Material (CNM), the "material" bureaus, designating them as system commands. At this

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[1]W. D. Gaddis, RAdm USN, Director of Budgets and Reports, Office of the Comptroller, Department of the Navy. Address before the Navy Financial Management Class. 4 March 1969.

time, the project manager concept received increased emphasis, after the notable success of the Polaris Project. The CNM saw a need for tying together the new organization through improvements in the management information system, thus providing for more effective functioning at the top NMC management level. The need was corroborated by management consultant findings, which indicated that improvement was possible. It was stated that the following principles and system characteristics should be pursued for further development:

> - The system must first satisfy requirements for information essential to the accomplishment of the mission of the CNM.
> - It must be primarily responsive to the management information requirements of the CNM and his senior staff.
> - It must support the task of control, i.e., the management functions of monitoring, evaluating, reporting, coordination, establishing policy, guiding and directing.
> - It should not duplicate other NMC systems.
> - It will, therefore, generally be concerned with selected summary information produced to a large degree by the operating systems of lower echelons.[1]

In August of 1966 a joint letter from the Commanders in Chief of the Atlantic and Pacific Fleets advised the Chief of Naval Operations of serious deficiencies in the quality and quantity of logistics information which was necessary to maintain the Navy logistics system.[2] Specifically, the letter stated that the Navy did not have an integrated logistics management capability, nor did the present organizational concepts provide fleet commanders

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[1]Rudden, "Management Information", p. 14

[2]Joint ltr. from CINCLANTFLT/CINCPACFLT to CNO (CPF Ser 43/5135J; CLF Ser 2830A/431) of 31 August 1966.

with an integrated logistics management capability. It also stated that a system is required to:

1. Respond accurately in a timely manner to queries of higher authority.
2. Increase credibility.
3. Provide a common reference base.
4. Focus attention on problem areas.
5. Be compatable with existing DOD and other management systems.
6. Interface with other functional areas such as operations, intelligence and readiness.[1]

The Fleet Commanders, stating urgency in the solution of the problem was mandatory, recommended that immediate action be taken to integrate the development of CNO/Fleet/CNM ADP programs to provide the vehicle for an evolutionary development into a Navy logistic information system. "The objective of the plan is therefore to define the problem, coordinate previous actions, identify interface in functional areas, eliminate duplication, provide an intended course of action to solve the problem, and establish an ultimate objective."[2]

The expression of urgent concern regarding the ever widening gap between the need for logistics information and the capability to provide it, received immediate reaction by Navy top management. In early 1967, the Secretary announced the implementation of a new long-range plan for orderly improvement of computer-based information systems and automatic data processing capabilities within the Department. He directed the development of a Department of the Navy Management Information and Control

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[1] Ibid., pp. 1-2.

[2] Ibid., encl. (1) p. 1.

System (DONMICS), the concept of which was essential to development of management information systems within a Departmental master framework.[1] In July of 1968 the concept was promulgated.[2]

The beginnings of more centralized direction over the development of information and data systems did not occur until about 1965, despite guidelines and concepts having been issued six years previously. The bottom-up development of standard systems for similar types of activities and functional areas was stressed, and many were developed, but this bottom-up development suffered from lack of systems interface. The limited computer capabilities, inadequate communication equipment, and the lack of in-house ADP expertise have been cited as reasons why it was considered impractical to attempt to manage ADP systems development as an integrated whole--from the top-down.[3] However, a problem of organization and management, and the absence of a full appreciation and recognition by top management of the necessity for strong central direction and backing, seem equally important factors in slippage of the original goals of achieving an integrated total systems approach to ADP systems development.

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[1]U. S., Department of the Navy, SecNavNote 5200 of 4 February 1967.

[2]U. S., Department of the Navy, SecNavNote 5200 of 16 July 1968.

[3]Robert B. Barker, Director, Information Systems Development Division, Office of Information Systems Planning and Development, Office of the Secretary of the Navy, Department of the Navy. Presentation given to the Assistant Secretary of Defense (Installations and Logistics), Conference for review of Automated Logistics Systems, Fort Ritchie, Maryland, 13 September 1968.

In retrospect, it may seem, perhaps, overly harsh to so judge--I think not.

In the Fall of 1968, several things were stated to have occurred since 1965 to have changed the management philosophy:

> First--Third generation computers have been introduced with new capabilities such as: high-speed memories, faster access to data, cheaper, concurrent processing of programs, more flexibility, more reliability, and far better software.
>
> Second--Communications equipment capabilities have greatly improved.
>
> Third--Top management is becoming increasingly concerned at the rising costs of ADP systems and computer operations, which in Navy are near $250,000,000 annually.
>
> Fourth--Considerable in-house ADP analysis and programming talent has evolved.
>
> Fifth--The President, the Secretary of Defense, and the Congress have each expressed a personal interest in improving ADP management--[sic] and in fuller exploitation of the computer's full capabilities.
>
> Sixth--Secretary Nitze, while Secretary of the Navy, became concerned because inadequate management information was reaching the SECNAV/CNO/CMC level on certain critical programs and directed that action be taken to provide such information.[1]

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[1] Ibid.

CHAPTER IV

THE PRACTICE OF MATERIAL LOGISTICS SYSTEMS DEVELOPMENT

Existing Systems

Material logistics is defined as the functional area that is concerned with the design, development, acquisition, storage, movement, distribution, maintenance, and disposition of Navy material. The word "material" is used in its broad sense to include weapons systems, conventional ammunition, petroleum, oils, lubricants, and supporting facilities, supplies, and equipment.[1]

To an extent this "commodity" definition gives some indication of the organization of the Naval Material Command (NMC), the organization responsible for the material logistics support needs of the Operating Forces. The NMC has primary responsibility for the Navy material logistics system, that is, from the "producer" standpoint, the basic design and development of the system. Organizationally, however, the subordinate "system commands", successor organizations to the "material bureaus" of long standing, are organized and still operate to

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[1]U.S., Department of the Navy, NAVMATINST 5430.38, Navy Logistics Information System (NAVLIS) Project (PM 14), 29 November 1968.

some degree along commodity or functional lines. At the risk of oversimplification, but by way of illustration, it can be said that the system commands, such as the Naval Ordinance Systems Command, the Naval Air Systems Command, and the Naval Supply Systems Command are only recently exercising their responsibilities on a systems vice functional basis. There have been some notable "systems" improvements, under the "umbrella" of the NMC, as for example the introduction of important management techniques such as the integrated logistics support concept. However, the design and development of material logistics systems have up to 1965 proceeded largely independent of systems interface and integration. As earlier discussed this has resulted from a decentralized bottom-up approach to systems development as well as the lack of an overall plan.

The introduction of automated data processing capability into the material logistics systems in the Navy on a decentralized basis has resulted in, and at the same time highlighted, the rampant systems proliferation referred to earlier. This has been true in both the functional systems hardware and the companion management information systems.

> Until about three years ago--there was no central control in Navy over the development of information and data systems. Certain guidelines and concepts had been issued. The development of standard systems for similar type activities and functional areas was stressed and many were developed. However, there was no formal discipline which required ADP systems to be planned, reviewed, and approved at higher management levels. Because of the limited computer capabilities, inadequate communications equipment, and the lack of in-house ADP expertise, it was considered impractical

> to try to manage ADP systems development efforts from the top down as an integrated whole.[1]

Notwithstanding the virtues of any particular individual material logistics system, systems have, on-balance, developed independently of one another. These systems have not met the requirements of the total systems approach nor have they possessed the characteristics required by the Navy Material Management Information System, discussed in Chapters I and II, respectively.

It would be well to examine two existing major Navy material logistics systems, the Uniform Automated Data Processing Systems and the Maintenance and Material Management Program (3-M System), to determine the adequacy of the ADP utilization with respect to systems interface and integration. The UADPS systems, in effect or under development, consist of UADPS for Supply Management (SM) (Stock Points, Inventory Control Point and shipboard segments), Shipyards Management Information System (MIS), Major Industrial Air Stations (INAS), Ordinance Activities (NOMIS), and Public Works Centers (PWMS). UADPS (SM), is operational and is the forerunner of the other UADPS systems, having been under development since the early 1960's. The other UADPS systems are to varying degrees operational.

The UADPS (SM) is an integrated real-time management system designed to enhance fleet support and the economical

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[1]Barker, presentation, 13 September 1968.

operation of the Navy Supply System.[1] The scope covers these interface functional relationships in the Navy Supply System: purchasing, weapons support, transportation and materials handling, material funding, accounting, inventory management, fleet readiness, provisioning, interservice support, cataloging, storage, and reparables maintenance support. The present ongoing system has evolved because of a recognition of the lack of standard procedures for Navy supply management, the need for interface with the Defense Supply Agency System, and the requirement for rapid response to DOD directives, principally in the area of standard supply logistics procedures. The increased capability of computer system hardware to process huge amounts of automated inventory data, the increased demands for management information, and the required increased in productivity in view of the rising costs of supply gave additional impetus to the development of the standard UADPS (SM) system. The growth of the Project Manager concept in the weapons support area gave still further push to a system with the horizontal and vertical search capability.

UADPS (SM) is built on these fundamental concepts:

Centralized systems design

Uniform procedures

Compatible ADP hardware

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[1]Russell A. Jones, Captain, SC, USN, Director Information Systems Branch, Program Planning Office, Office of the Chief of Naval Operations, Department of the Navy. Presentation given to the Assistant Secretary of Defense (Installation and Logistics), Conference for Review of Automated Logistics System, Fort Ritchie, Maryland. 13 September 1968.

Operational analysis techniques

Rapid communication links

Full utilization of DOD military standard programs[1]

UADPS (SM) was essentially developed on a functional basis, by the Naval Supply Systems Command. UADPS (SM) development was a process of evolution, starting at its beginning with the standardization of those Navy's stock points and inventory control points under the control of the Naval Supply Systems Command. However since all of the Navy's "supply" management was not under the purview of the Naval Supply Systems Command, necessarily because of organizational constraints, UADPS (SM) is not yet a "total system". Nevertheless, significant progress has been made in the UADPS (SM) segment in the direction of the total system approach. In addition, several functional areas contained in the UADPS (SM) scope are not the sole responsibility of the Naval Supply Systems Command. Accordingly, progress toward total integrated supply management in the areas of weapons support, funding, accounting, fleet readiness and reparables maintenance has moved ahead at a pace less rapid than desired.

The second major material logistics system here addressed is the 3-M System. This system, although operational, is still evolving, and in its own right does not yet meet the requirements of the "total system". The system is designed to meet a requirement for collection of operating data to encompass

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[1] *Ibid*.

expenditure of maintenance resources, manpower and material, against all ships/aircraft and systems, subsystems and components thereof. The 3-M System consists of two major subsystems: a planning and control subsystem, that tells what, when, how and with what resources maintenance will be done; and a maintenance data collection subsystem, that gathers usage information concerning the specific ship/aircraft, subsystem or component, which will be used subsequently in future engineering, technical, and inventory control decisions.

In one measure, the Navy rates itself on the "material logistics systems scoreboard" as follows:

High, on centralized design and programming, integrated files within system, uniform procedures by function, intra-system communications, interface with DOD-wide systems, standard functional programs for common tasks, and performance of operational tasks, and

Low, on inter-system communications, machine independence, management information systems, standardization (data elements, documentation, language, software), interservice compatibility, and systems integration.[1]

The general Accounting Office in commenting on the management systems of the DOD had this to say about the 3-M System:

> . . . We believe that the basic objectives of the 3-M System are sound, but it is our opinion that the system was initiated without sufficient study having been made to provide clear definitions of what management information was needed and how the system was to satisfy needs.

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[1] Ibid.

> Moreover, although this system is interrelated with a number of other major management systems of the Navy, it was developed independently of them. It appears that very little attention was given to the interface problems among the systems during their initial development. . . .[1]

The GAO went on to indicate that the results of their inquiry into five Military Service and DSA computerized management systems showed that each of the systems was developed independently by the respective services and DSA to meet their individual needs, without regard to achieving interservice compatibility of common-purpose management systems. Of the five systems, four were material logistics systems. None of these systems was designed and developed as part of an overall integrated plan within DOD.[2]

The GAO concluded that, "until the DOD devises and implements one overall plan and the planning and development of major ADP systems are closely controlled within the framework of the plan, conditions such as those encountered by the Navy will continue to occur throughout the DOD at a significant expenditure of time, effort, and funds."[3]

Trends of the Future

What of the future? The Department of the Navy Management Information and Control System (DONMICS) concept was developed to solve the problems earlier associated with previous

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[1]U.S. General Accounting Office, Inquiry into Practices, p. 4.

[2]Ibid.

[3]Ibid., p. 7.

Navy efforts to achieve an integrated management information system. DONMICS provides the conceptual framework to guide the long-range development of the integrated management information system. With it should come better planning, focal points pinpointing responsibility, adherence to the requirement for standard data elements and codes, better inventories of equipment and systems, and use of compatible programming languages.

Still required are better and more detailed plans at a higher, centrally controlled level. A mechanism must be found to have top management understand and resolve system development problems associated with organization, management and command relationships. Total systems compatibility and integration depends on such resolution. Cost and effectiveness indicators are required in order for top management to gauge the system(s).

In October 1968, the Assistant Secretary of Defense (Installations and Logistics) directed that a jointly staffed group be established to identify common logistics processes and assure that logistics systems interfaces and integration are facilitated through a set of common policies and objectives which would provide the basis for a long-range material management systems "blueprint".

> This blueprint should provide a basis for more economical use of scarce ADP resources during the long lead time required for systems development and assure the continuing usefulness of Military Standard (MILS) procedures in future logistics systems. In this way, we can assure that the next generation of systems changes, which will begin to occur in mid-1970's, takes full advantage of the lessons learned in automation of similar logistics processes in other DOD Components. To achieve this goal,

> this Office will foster more formal arrangements for cross-fertilization of ADP systems development, experiences and ideas.[1]

It appears that there is some unanimity as to the problems confronting the development of a total systems approach to automated material logistics development. The Office of the Assistant Secretary of Defense (Installations and Logistics), the General Accounting Office and the Department of the Navy seem to have arrived at substantially the same conclusions. Translated into the language of the Navy "material logistics systems scoreboard" what is needed is strong centralized top-down control, design, and programming on a DOD-wide basis in order to approach achievement of the total system. The trend is there. Carried to an extreme this kind of solution would be both harsh and dangerous. Yet some modification of stronger central direction and control is required. The continued proliferation of systems would, of course, be an "un-system".

There remains to be seen what the DOD "blueprint" or the Navy's NAVLIS Project will bring in the future.

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[1]U.S., Department of Defense. Office of the Assistant Secretary (Installations and Logistics), "Automated Logistics Systems Planning," Memorandum for the Assistant Service Secretaries and the Director, Defense Supply Agency. 8 October 1968.

CHAPTER V

INTERFACING SYSTEMS DEVELOPMENT

The interrelationship between the concept of the total system and the concept of information systems is evident. Communications, the connecting link in the basic management processes, is also the means through which the organization hierarchy is served by the information system.

A "total information system" might be described as an information system consisting of at least all information subsystems of all components of the entire organization, linked together through an interfacing data base, manual or automated, and responsive to the information needs of all levels of the management hierarchy, functional as well as system, inorder to support the goals and objectives of the total organization in the decision-making process. Integration presupposes minimization, if not elimination, of redundancy. A total information system is achieved only by application of a total systems approach.

The total systems approach is thus inherent in the Navy Logistics Information System (NAVLIS), the vehicle by which the NMC intends to interface the various material logistics information systems in the Navy and by that process integrate the Navy material logistic systems.

NAVY LOGISTICS INFORMATION SYSTEM (NAVLIS) PROJECT

It will be recalled that the Fleet Commanders plea was for development of a Navy logistics information system. While the genesis of DONMICS is largely in response to the Fleet Commanders call, the specific response to the Fleets was the Navy Logistics Information System (NAVLIS) established as an operational requirement by the Chief of Naval Operations in December 1967. The Chief of Naval Material (CNM) was assigned the responsibility, as the principal developmental agent for Naval logistics. Under the auspices of the Naval Supply Systems Command, given the task of developing the proposed technical approach, a NAVLIS workshop was held at the center for Computer Science and Technology, National Bureau of Standards, Gaithersburg, Maryland in March of 1968 under the direction of Rear Admiral T. B. Owen, USN. The NAVLIS workshop determined that present information systems did not provide for vertical aggregation of data from the lower organizational elements into condensed information requirements for management. It was further determined in that the requirement for information to support decision-making in the logistics system, coupled with the unresponsive system for providing information had resulted in a proliferation of data systems. Approximately 500 automated logistics systems were identified, most of which were mutually exclusive. In addition to the inability to move data from one system to another, the lack of data quality control and the workload caused by redundant input requirements were also identified as major problems.

The Research and Development Division of the Naval Supply

Systems Command incorporating the efforts of the Workshop developed a proposed technical approach which was approved by the CNM in August of 1968. On 29 November 1968, to provide for the establishment of exceptional management policies, NAVLIS was given Project status as NAVLIS Project (PM 14) under the immediate direction of the CNM.[1] The CNM felt NAVLIS warranted project status under his direct supervision to provide "The giving of particular attention to the management and allocation of resources assigned to [the] Project which is critical to the Nation's defense posture and costly to the Department of Defense; . . ."[2] NAVLIS is an R&D project having as its goal the implementation of a world-wide material logistics information system. Establishing NAVLIS as a formal Navy project under a Project Manager is a definite first. This approach represents a break with the past. Traditionally, R&D was the exclusive preserve of weapons systems development, such as Polaris, Surface Missile System, and the FDL. Management systems were expected to come into being "automatically" to support the weapon or "hardware" systems. Until recently, these expectations were generally realized. Unfortunately, the advent of general purpose computers, the rapid growth in size of the Naval establishment, and the tremendous increase in weapons systems complexity have outmoded the traditional approach. As PM 14, NAVLIS thus represents the

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[1]U. S. Department of the Navy, NAVMATINST 5430.38, Navy Logistics Information System (NAVLIS)Project (PM 14), 29 November 1968.

[2]*Ibid.*, p. 1.

first major application to management systems of the kind of long-range planning that has been used successfully in major weapons systems development.[1]

Project Task

The NAVLIS Project has been tasked with providing all management echelons with a Navy Logistics Information System which will satisfy information requirements for approved operations. Using the existing information systems as a base, the tasks to be performed by the NAVLIS Project include the definition, development, test and evaluation, acquisition, initial installation and support of the NAVLIS System. Included in the software portions of the Project are survey reports of equipment, data requirements and availability, and standardization requirements; analytical studies; plans for installation and tests; system specifications; the development of a simulation capability; and prototype development.[2] The task of interfacing and integrating various components of the material logistics system is a task of obvious great magnitude.

Scope

NAVLIS is one of several functional components of NAICOM/MIS(Navy Integrated Command/Management Information System)

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[1]S. L. Greenblatt, Program Analyst, Navy Logistics Information Systems (NAVLIS) Project (PM14), Naval Material Command Headquarters, Department of the Navy. Personal Interview. 10 April 1969.

[2]NAVMATINST 5430.38, encl. (1), p. 1.

of the Chief of Naval Operations.[1] NAICOM/MIS is itself a subsystem of DONMICS). As the total material logistics subsystem, NAVLIS will furnish technical guidance in the development of logistics modules of command/management information subsystems external to the Naval Material Command (NMC), including the Fleets. NAVLIS will be the principal channel for providing information input into the logistics module of the NAICOM/MIS. The NAVLIS concept provides for a data flow from the point of origin to the point of decision, regardless of the location of these points, afloat or ashore. This approach provides the complete vertical integration of the material logistics subsystems of NAICOM/MIS. Interface capabilities will be developed between NAVLIS and extra-Navy interfaces such as the other military services, DSA, and GSA. NAVLIS is the first attempt within the Navy to view the material logistics system as an integrated whole.[2]

Initial operation of the first module is scheduled for FY 1975. Full operation of the NAVLIS is expected by 1980, but with proper funding and management support, this date could be advanced by three or four years. The NAVLIS advance development schedule projected to 1975 testifies to the scope and complexity of the project. The schedule may prove to be optimistic in view of experience in the development of other major systems. The

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[1]Xefteris, Zefter C., Capt. (SC) U. S. N. Director, Policy Development and Review Division, Naval Supply Systems Command Headquarters, Department of the Navy, Personal Interview. 20 March 1969.

[2]Greenblatt, personal interview.

NAVLIS concept does, however, anticipate substantial benefits to accrue prior to implementation through modular improvement to existing systems.

All the logistics systems under the purview of the NMC are NAVLIS related. Accordingly, NAVLIS will be designed to pull together the management information systems of these subsystems. The major goal of NAVLIS is to provide the logistics manager with more responsive, credible, and accurate information than he can get today. The tool proposed by NAVLIS to mitigate the inefficiencies inherent in functionally specialized ADP system proliferation, is integration. NAVLIS will attempt to integrate these systems through interface capabilities that will permit high utilization of the ADP capabilities throughout the entire NMC. The systems involved in the integration will be the major process oriented or horizontal systems such as UADPS for Supply Management, Shipyards, and Air Stations and the management oriented or vertical systems such as 3-M and ACCESS. In addition, NAVLIS will provide input to superior information systems (e.g., DONMICS, NAICOM/MIS. and the World-wide Military Command and Control System), and will provide guidance in the development of the logistics segments of information systems outside the NMC (e.g., to the Fleets).

"NAVLIS will be a network of integrated and compatible supply, maintenance, facilities, and transportation [information] systems serving both the CONUS and the fleet. NAVLIS is an extremely costly and complex undertaking. It will require both

resources and new logistics policy decisions as it progresses if its objectives are to be achieved".[1]

Objectives

The specific objectives of the NAVLIS are to:

1. Greatly reduce currently inordinate demands on operating forces for redundant data collection and reporting through the concepts of one-time input and source data automation.
2. Standardize and control proliferation of logistics systems through integration of current systems, and systems augmentation to encompass future information requirement.
3. Impose discipline on systems development and operation to eliminate non-uniform procedures and require adherence to NAVLIS generated guidelines and standards.
4. Effect inter-system communications to permit data transfer among related systems.
5. Develop and implement new standards and concepts of quality control to ensure NAVLIS credibility.
6. Significantly improve the quality, quantity, and timeliness of logistics information to serve the dynamic needs of management at all levels.[2]

Conceptual Approach

In addition to the basic elements involved in developing systems,[3] eight system design precepts will be incorporated into the system in order that the objectives can be achieved. The precepts are intended to overcome those deficiencies or problems associated with the existing non-integrated systems, namely: inadequate information for decision-making; proliferation of systems; inordinate demands on the operating forces; non-uniformity of procedures, formats, etc.; inability to move data between

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[1]Barker, presentation, 13 September 1968.

[2]Greenblatt, personal interview.

[3]Johnson, The Theory, pp. 341-345.

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systems, lack of effective quality control, and the redundancy of input and reporting. The eight precepts are:

1. Micro input.
2. Integration of data banks.
3. Multiple use of a single input.
4. Data aggregation.
5. Multi-level access.
6. Vertical search.
7. Adaptive capability.
8. Inter/intra service compatibility.

The first precept of micro input involves the entry of data into the system, in its smallest element, at one time and one place. Standard data elements and codes will facilitate the identification of micro inputs and minimize duplicate inputs into the system, thereby alleviating the inordinate demands on the operating forces for burdensome reports. The precept of integration of data banks does not embrace the notion of a single large data bank, but rather the use of multiple, geographically dispersed data banks linked together through a system of equipment, communications, languages, data elements, codes, and procedure. On-going efforts in the Navy are oriented to centralized analysis and programming, the application of the standard COBOL, standard file structure, and standard data elements and codes. Multiple use of single inputs provides a significant potential for workload reduction and input redundancy. Data aggregation is required for the development of information from data as it ascends the management hierarchy. Multi-level access implies the use of

data at all decision levels. The system must provide access to data by all levels of management having a need. Vertical search is the capability of any decision level to search any level of detail or summarization, independent of this position in the organization or management structure. This capability is a key to system responsiveness. The precept of adaptive capability permits a newly stated query to be placed into the system without requiring the whole system to be reprogrammed. The precept of inter/intra service compatibility is the capability of the system to interface with similar systems in the DOD.

The system, using an integrated and unified data base, will assist in decision-making at all levels by providing user access to all pertinent logistics data, regardless of geographical or organizational separation. The integrated system will horizontally and vertically interface with subsystems, and will be flexible (modular) so that it can accommodate growth in all directions (such as the introduction of new equipment, new software capabilities, organizational changes, and system component failures).[1]

In order to meet the system objectives the following features will be incorporated into NAVLIS: system-sharing control; conversational mode query capability; data map module; data analyses and projection module; report generator; output configuration control; self-management capability; scheduling

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[1]Department of the Navy, Naval Supply Systems Command, Research and Development Division, brochure "NAVLIS", p. 14. (undated).

and ADP resource control; communications control; and interface module.

The NAVLIS Project, thus envisions a total systems approach to the development of a Navy Logistics Management Information System.[1] This has not been attempted before.

Management Actions Supported

The types of management action supported:

1. Assessment of operational readiness of forces and identification of critical logistic support needs.
2. Allocation of maintenance and repair resources.
3. Translation of operational plans into logistic support requirements.
4. Development and maintenance of logistic planning factors.
5. Maintenance of logistics asset records.
6. Control of logistics asset and acquisitions dispositions.
7. Evaluation of operational and contingency plans for logistics feasibility.
8. Evaluation of logistics support effectiveness.
9. Preparation of budgets.[2]

The types of management action supported require utilization of many diverse information systems. A primary advantage of the NAVLIS concept is the integration of a broad spectrum of information, which is required for management action, into a single pool, in readily accessible format. Such an approach will reduce the need for any proliferation of single function management information systems.

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[1]Robert M. Weiss, personal interview, Operations Research Analyst, Navy Logistics Information Systems (NAVLIS) Project (PM14), Naval Material Command Headquarters, Department of the Navy, 21 April 1969.

[2]Brochure "NAVLIS", p. 23.

Benefits of the System

The following benefits are sought from the NAVLIS:

1. Provide better information relevant to evaluation of logistics management.

2. Provide for historical information for the conduct of logistics analysis.

3. Provide information to conduct feasibility evaluation of logistics decisions through simulation modeling at required management levels.

4. Make information available, as required, for real-time management control of on-going systems.

5. Assure continuous system maintainability and reliability to improve the speed, continuity and quality of logistics information.

6. Minimize human and hardware investment in information retrieval operations and low-order decisions.

7. Provide information compatibility intra-Navy and extra-Navy.

8. Meet user security requirements to protect the integrity of functional subsystems.

9. Provide for measurement of logistics systems performance.[1]

[1]Greenblatt, personal interview.

Evaluation

Conceptually, NAVLIS is a supersystem, or total information system, encompassing all Navy material logistics information systems.

However, NAVLIS must be evaluated as a total information system in terms of its meeting the needs of the Navy material logistics organization. To do so, we may examine the System by comparing it to certain criteria previously discussed. Specifically the practical application of NAVLIS as a total information system depends on: 1) the existence of a certain environment, both external and internal to NAVLIS; and 2) the specific features of the System itself. It must, therefore, meet the requisites of both the total system approach and an effective information system, which were discussed in Chapters I and II, respectively. These requirements are not, of course, mutually exclusive.

The viable total system approach is dependent on: top management backing; thoroughly defined and understood goals and objectives; filtered information; communication linkage; automatic data processing capability; building block capability; optimum standardization of functional systems/subsystems and integration of the data base; an integrated data bank; and a competent developmental staff. An effective management information system would be an organized method of providing each level in the management hierarchy with meaningful information to support the decision-making process. Accordingly, the system

would satisfy requirements for information essential to mission accomplishment; be responsive to top management; support the task of control, monitoring, evaluating, reporting, coordinating, establishing policy, guiding and directing; and be integrative, not duplicative of other interface systems.

The criterion for a total management information system appear to be met in NAVLIS. Some to a lesser degree than others, however. The eight design precepts of the NAVLIS system result in the technological capability to function as an integrated total material logistics management information system. The System possesses automatic data processing capability, a filtered information feature, communication linkage, building block capability, capability to optimize standardization of functional systems/subsystems through integration of the data base, and an integrated data bank, all of which are conditions of the total systems approach.

If one can accept the total systems approach or the total information system, then NAVLIS can be said to qualify as both. Notwithstanding the fact that there are knowledgeable people in the field that do not accept the concept of a total information systems as being practical when it comes to the business of day to day management, I believe we can accept the concept as being valid, if its practical limitations are recognized.

First, while NAVLIS encompasses all Navy material logistics informations systems, and has been identified by its proponents as a total system, it must be remembered that it is, itself, a subsystem of DONMICS, the Departmental master

framework. In this sense, then, NAVLIS as a "total system" has relevance only if we acknowledge that as a total system it is limited by the totality of the Navy material logistics information systems which it encompasses.

The second practical limitation is that there will always exist those types of environmental information, that Dearden referred to as the "five dichotomies of information", primarily external and futuristic in nature, that will affect and may disrupt the perfecting of the total system.

Third, because the perfection of the total system is affected by environmental change, the total system becomes evolutionary in growth and operation. The evolutionary development is, in one sense, good because it prevents the stagnation of set organizational patterns that lead to parochialism.

Technological considerations may not be the greatest obstacles to the success of the NAVLIS Project. The potential problems that may beset NAVLIS concern management--specifically management emphasis. Some of the obstacles to NAVLIS success could be:

1. Diminishing of present Navy top-management interest in the total management information systems concept.

2. Funding limitations or cutbacks in either the R&D phase or the eventual operational phase of NAVLIS.

3. Lip-service to the NAVLIS project management concept in favor of further decentralized development of data systems leading to additional systems proliferation.

4. Well known resistance to change, through genuine lack of understanding or the parochialism of the "bureau" system.

5. Lack of progress or slippage in integration of "super" information systems.

6. Failure of necessary follow through with standard material logistics systems development at the DOD level.

7. Delay through failure to resolve interface differences in existing essential operational subsystems.

8. Failure of top-management to provide "strong central direction" by the retention of the present method of guidance and "control" through coordination.

4. Well known resist[illegible] change [illegible] lack of understanding of the [illegible] system.

5. Lack of [illegible] "super" information systems.

6. Failure of necessary [illegible] material [illegible]

7. [illegible] ences in [illegible]

8. [illegible] "directi[illegible] "control" [illegible]

CHAPTER VI

CONCLUSION

The total system approach is a logical manner in which to design and develop a goal directed system. To reach a goal, concrete or abstract, there is one or several alternative ways to reach the goal, depending on given objectives. The systemized approach in reaching a goal considers the environmental constraints, physical, moral, legal, economic, etc., that are imposed. A choice among alternatives is available; the choice should be made in accordance with the goal and objectives. The more complex the system, e.g., an individual person vis-a-vis an aircraft carrier, the more important the choice among alternatives becomes.

Adequate recognition of the super system/subsystem relationships involved in the material logistics system must be made. The relationship between material logistics system and subsystems varies depending on the level of organizational hierarchy and function. The ultimate goal of the DOD material logistics system is to support the operating force requirements of the Defense Establishment. The goal and objectives of any subordinate segment in the DOD material logistics system should be congruent with those of the superior system. Singleness of

purpose among all subsystems is fundamental to achieving the ultimate by optimumly selecting among alternatives.

The environment in which the Navy operates today is at one and the same time inspiring and frightening; inspiring because of the unlimited paths that may be taken in the technological revolution; and frightening because of the need to have the management ability to take the optimum path.

The technological capability exists to plan and develop automated material logistics systems on a total system basis. The total systems approach offers a method of integrating both program and systems to achieve standardization and compatibility on a government-wide, as well as DOD and military service basis. The concept of a total management information system provides a means by which programs and systems can be controlled and monitored.

Increased pressure continues from the Congress and the Executive Branch for centrally directed plans and integrated systems in the DOD and other agencies. With more and more tax dollars being funneled into new, socially-oriented programs these pressures should continue. At the OSD and military service level there is a growing recognition of the urgent need for additional standardization and integration in material logistics planning and development. Favorable experience with the project management concept, and the proven effectiveness of the Defense Supply System and the standard "MILS" systems have served to sharpen the focus on the need.

The Navy's on-going NAVLIS project and the DOD "blueprint" study effort are examples of the importance attached to a total system approach to automated material logistics planning and development. The present top management emphasis must be continued. There are indications that the trend to systems integration will continue at perhaps an even faster pace than heretofor. Organizational change considerations should be made. Existing organizational patterns in the DOD or Navy should not be allowed to impede progress in achieving the necessary systems integration.

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